



C04283



MEMOIRS .  
OF THE  
GEOLOGICAL SURVEY OF INDIA:

*Palaontologia Indica,*

FIGURES AND DESCRIPTIONS OF THE ORGANIC REMAINS PROCURED DURING  
THE PROGRESS OF THE GEOLOGICAL SURVEY OF INDIA.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

Ser. XII.

THE FOSSIL FLORA OF THE GONDWANA SYSTEM.

Vol. IV.

Pt. 1. THE FOSSIL FLORA OF THE SOUTH REWAH GONDWANA  
BASIN.

(WITH PLATES I—XXI.)

By OTTOKAR FEISTMANTEL, M.D.,  
Palaontologist, Geological Survey of India.

CALCUTTA :

SOLD AT THE

GEOLOGICAL SURVEY OFFICE. AND BY ALL BOOKSELLERS .

LONDON : TRÜBNER & CO.

MCCCCLXXXII.

PRINTED AT THE OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA, 160, BHCURUMTOLLAR STREET, CALCUTTA.





MEMOIRS  
OF THE  
GEOLOGICAL SURVEY OF INDIA.

*Palæo tologia Indica,*

BEING

FIGURES AND DESCRIPTION OF THE ORGANIC REMAINS PROCURED DURING  
THE PROGRESS OF THE GEOLOGICAL SURVEY OF INDIA.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

Ser. XII.

THE FOSSIL FLORA OF THE GONDWANA SYSTEM.

Vol. IV.

Pt. 1. THE FOSSIL FLORA OF THE SOUTH REWAH GONDWANA  
BASIN.

(WITH PLATES I—XXI.)

By OTTOKAR FEISTMANTEL, M.D.,  
Palæontologist, Geological Survey of India.

CALCUTTA :

SOLD AT THE

GEOLOGICAL SURVEY OFFICE, AND BY ALL BOOKSELLERS  
N. TRUBNER & CO.

PRINTED AT THE OFFICE OF SUPERINTENDENCE OF GOVERNMENT PRINTING, INDIA, 169, BARRACKPORE STREET, CALCUTTA.



# CONTENTS.

INTRODUCTORY REMARKS . . . . .	1—2
Stratigraphical distribution and localities . . . . .	3—18
A.—Upper Gondwānas . . . . .	3—5
Jabalpur group . . . . .	3—5
Maléri beds . . . . .	5
B.—Transitional beds . . . . .	5—7
C.—Lower Gondwānas . . . . .	7—18
Raniganj group . . . . .	7—13
a. —Gopat area . . . . .	7—9
b. —Sohāgpur area . . . . .	9—13
Barākar group . . . . .	13—14
Kachharbāri beds . . . . .	15—17
Talechir group . . . . .	17—18
Systematic list of fossils . . . . .	18—20
Description of fossils . . . . .	20—50
EQUISETACEÆ . . . . .	20—23
<i>Schizoneura gondwanensis</i> , Feistm. . . . .	21—22
<i>Trizygia speciosa</i> , Royle . . . . .	22
<i>Vertebraria indica</i> , Royle . . . . .	22—23
FILICES . . . . .	23—39
<i>Gleichenia rewahensis</i> , n. sp. . . . .	24
<i>Danaopsis hughesi</i> , Feistm. . . . .	25—27
<i>Sphenopteris polymorpha</i> , Feistm. . . . .	28
<i>Dicksonia hughesi</i> , Feistm. . . . .	28
<i>Asplenium whitbyense</i> , Heer. . . . .	28—29
<i>Asplenium</i> comp. <i>whitbyense</i> , Heer. . . . .	29
<i>Alethopteris medlicottiana</i> , Oldh. . . . .	30
<i>Thinnfeldia odontopteroides</i> , Feistm. . . . .	30—31
<i>Macrotaniopteris feddeni</i> , Feistm. . . . .	31
<i>Angiopteridium</i> comp. <i>m'Clellandi</i> , Oldh. and Morr. . . . .	31—32
<i>Glossopteris</i> , Bgt. . . . .	32—37
a.—Forms with narrow nets . . . . .	32—34
<i>Glossopteris communis</i> , Feistm. . . . .	32—33
<i>Glossopt. indica</i> , Schimp. . . . .	33
<i>Glossopteris stricta</i> , Bunb. . . . .	33—34
b.—Intermediate forms . . . . .	34—35
<i>Glossopteris cordata</i> , n. sp. . . . .	34
<i>Glossopt. browniana</i> , Bgt. . . . .	34—35
c.—Broad-netted forms . . . . .	35
<i>Glossopt. damudica</i> , Feistm. . . . .	35
<i>Glossopt. retifera</i> , Feistm. . . . .	35
d.—Narrow-leaved forms . . . . .	35—37
<i>Glossopteris angustifolia</i> , Bgt. . . . .	35
<i>Glossopt. formosa</i> , Feistm., var. <i>major</i> . . . . .	36

	PAGE.
<i>Glossoptis tanioides</i> , n. sp. . . . .	36—37
<i>Gangamopteris cyclopteroides</i> , Feistm. . . . .	37
<i>Gang. cyclopt.</i> var. <i>sabauriculata</i> , Feistm. . . . .	38
<i>Gangam. cyclopt.</i> var. <i>attenuata</i> . . . . .	38
<i>Gangam. major</i> , Feistm. . . . .	38
<i>Gangam. comp. angustifolia</i> . . . . .	39
<i>Sagenopteris</i> ? sp. . . . .	39
<i>Dictyopteridium</i> ? sp. . . . .	39
CYCADACEAE . . . . .	39—43
<i>Zamia</i> . . . . .	39—43
<i>Podozamites lanceolatus</i> , L. and H. . . . .	39—40
<i>Podozam. spathulatus</i> , n. sp. . . . .	40
<i>Platophyllum cutchense</i> , Morr. . . . .	40
<i>Nöggerathiopsis hislopi</i> , Feistm. . . . .	41
<i>Nöggerathiops. lacerata</i> , n. s.p. . . . .	42
<i>Squamæ</i> . . . . .	42
<i>Carpolithes milleri</i> , Feistm. . . . .	43
CONIFERAE . . . . .	43—50
<i>Abietaceæ</i> . . . . .	43—47
<i>Voltzia heterophylla</i> , Bgt. . . . .	43—44
<i>Palissya jabalpurensis</i> , Feistm. . . . .	44
<i>Araucarites cutchensis</i> , Feistm. . . . .	44—45
<i>Araucar. macropterus</i> , Feistm. . . . .	45
<i>Araucar. latifolius</i> , n. s.p. . . . .	45—46
<i>Pachyphyllum peregrinum</i> , Schimp. . . . .	46
<i>Pachyphyllum</i> , s. p. . . . .	47
<i>Taxodiaceæ</i> . . . . .	47—48
<i>Echinostrobus expansus</i> , Schimp. . . . .	47—48
<i>Echinostr. rhombicus</i> , Feistm. . . . .	48
<i>Brachyphyllum mammillare</i> , Lindl. and Hutt. . . . .	48
<i>Taxaceæ</i> . . . . .	48—49
<i>Taxites planus</i> , Feistm. . . . .	48—49
<i>Salisbureæ</i> . . . . .	49
<i>Ginkgo</i> , sp. . . . .	49
<i>Seeds</i> — <i>Samaropsis</i> ? sp. . . . .	50
General Remarks. . . . .	50—51
Comparison with other Gondwana basins . . . . .	51—52

# THE FOSSIL FLORA OF THE GONDWÁNA SYSTEM IN INDIA.

VOL. IV.

## 1. THE FOSSIL FLORA OF THE SOUTH REWAH GONDWÁNA BASIN.

By OTTOKAR FEISTMANTEL, M.D.,

PALEONTOLOGIST, GEOLOGICAL SURVEY OF INDIA.

WITH PLATES I—XXI.

THE present Memoir treats of the flora of the great South Rewah Gondwána basin, which may be indicated as that complex of Gondwána rocks lying for the most part between the Jabalpur district on the west and the South Mirzapur district on the east. The principal rivers traversing this area from south to north are the Son and the Gopat, the latter being a tributary of the former. An eastern prolongation of this basin extends through Sirguja, comprising the small coal-fields of Ramkola and Tatapani, into proximity with the Hutar field of the Palamow group in Bengal. On the west the South Rewah field is connected by a narrow band of Upper Gondwána rocks with the Sátpura basin; and to the south-east an expanse of Talchir beds connects it with the fields of the Mahánadi basin.

Until quite recently (1880) the knowledge both of the stratigraphical and palæontological relations of this extensive area was rather imperfect, hardly any examination of it having been undertaken, and consequently the number of fossils procured was small. Only of the extreme western portion was there an account by Mr. J. G. Medlicott.<sup>1</sup> Of somewhat later date are two collections of plant fossils made by Mr. J. G. Medlicott, one of which is labelled "South Rewah, 1861," and the other one "Sohápur, 1861." No distinct horizon could be assigned to these fossils then; but we now know that they belong to the Raniganj group, and that the former specimens are most probably from the Gopat area.

In 1872 another addition was made to the South Rewah fossils by Mr. C. A. Hackett, who collected fossils at three localities, *viz.*, at Gurárú on the Son river

<sup>1</sup> Report on the geological structure of the central portion of the Nerbudda District. Mem. Geol. Surv., India, Vol. II, pt. 2, 1860.

(Raniganj group fossils), near Chandia, west of Báñdhogarh fort, and from the Umrar nadi, above Burgaon (Jabalpur group fossils).

When Mr. Blanford wrote the chapter on South Rewah and Sohágpur, for the *Manual of Indian Geology*,<sup>1</sup> besides of the published account of Mr. J. G. Medlicott, he availed himself also of the manuscript reports of Messrs. J. G. and H. B. Medlicott, C. A. Hacket and F. R. Mallet, so that his description contains a summary of all what was known about the geological structure of the area up to that date.

Since October 1879 this extensive area has been under survey by Mr. T. Hughes, who will no doubt furnish an exhaustive account of it. Three short notices by Mr. Hughes have already been published on different parts of the South Rewah basin, from which it is evident that the geological relations are most interesting.

Mr. Hughes has also succeeded in bringing together a good collection of fossils, both plants and animals, the former predominating. Upon the first collection, sent early in 1880, a brief note was given by myself,<sup>2</sup> which also included the fossils collected before by Messrs. J. G. Medlicott and C. A. Hacket. Some additional fossils, sent by Mr. Hughes later on in 1880, were noticed by me in a supplementary list, appended to my *Damuda-Panchet Flora*.<sup>3</sup> But subsequently Mr. Hughes sent three more collections, one in 1881 and two this year. All the fossils went to show that most of the horizons recognised elsewhere in the Gondwána system are present in this extensive rock-basin; and though in some cases doubtful, yet in the majority the horizons may be considered as well defined. Although it is not improbable that some new fossils may still be unearthed, it is desirable to publish what we know about these fossils now, as some time must elapse before Mr. Hughes' *Memoir on the Geology* can be ready, and many of the fossils are of no small interest. There is no intention on my part that this publication of my examination of the fossils, and of the definition of the horizons based thereon, should in any way prejudice Mr. Hughes' ideas on the geology of that district; and I sincerely hope that when he publishes his *Memoir* it will be found that our views are coincident, or at least nearly so. It is indeed likely that the main stratigraphical portions, as already indicated in Mr. Hughes' published papers, will not undergo much modification.

To avoid repetition I shall not describe the fossils of each horizon separately, but all together in biological sequence, indicating with each fossil its geological and geographical distribution. Before this I give a view of the distribution of the fossils according to groups and localities, with such explanatory remarks as appear necessary. A general list of the fossils precedes the description, and at end the distribution of the fossils according to the horizons is shown.

For convenience sake I have arranged the localities under the headings of the several groups as heretofore established, to which they most nearly belong, still classing the latter under the usual headings of Upper and Lower Gondwánas. But nowhere is this twofold division more arbitrary and conventional than here, as will be seen especially in the case of two localities which I shall point out.

<sup>1</sup> Vol. I, p. 201, 1879.

<sup>2</sup> *Rec. Geol. Surv., India*, Vol. XIII, pt. 3.

<sup>3</sup> *Gondwána Flora*, Vol. III.

## STRATIGRAPHICAL DISTRIBUTION WITH LOCALITIES.

## A.—UPPER GONDWANAS.

## JABALPUR GROUP, 1871.

Some fossil plants of the Jabalpur group from South Rewah were already mentioned by me in my Flora of the Jabalpur group.<sup>1</sup> They were procured by Mr. C. A. Hacket at Chandia. On two subsequent occasions Mr. Hughes collected fossil plants also near Chandia, once in 1880 and again in 1881, and again only quite recently sent some specimens from another locality. I give separate accounts of these three collections.

BANSA, on the Machrar river, about 6 miles south-west of Chandia.

*Collectio Hughes, 1880. (Hacket, 1872.)*

1880. Feistmantel: Rec. Geol. Surv., India, Vol. XIII, pt. 3, p. 189 (list of fossils).

1881. Hughes: *ib.*, Vol. XIV, pt. 1, p. 138 (locality mentioned).

*Asplenium whiffeyense*, Heer (including *Alethopteris indica*, Old. and Morr.) Pl. I, figs. 1-9.

*Alethopteris medicottiana*, Fstm. Pl. I, fig. 14. The same form as described by me from Jabalpur. Its affinities are most probably with *Mertensia*, one of the *Gleicheniaceae*.

*Gleichenia rewahensis*, n. sp. Pl. I, figs. 15-19. The same species was collected by Mr. Hacket (in 1872) at the same locality in dark-grey carbonaceous shales. I figure some of the specimens, Pl. XX, 7-9.

*Podozamites lanceolatus*, L. & H.—numerous. Pl. II, figs. 2-5.

*Psilophyllum cutchense*, Morr.; one specimen, in dark sandy shale; the usual form; not figured.

*Palissya jabalpurensis*, Fstm. Pl. II, figs. 10, 10a. A somewhat more slender variety.

*Taxites planus*, Fstm. Pl. II, figs. 7-9, 11. This species has hitherto been known only from the Sripermatur group on the south-east coast of India (Ragavápuram shales, Sripermatur area and Vemáveram shales), and its occurrence in the Jabalpur group of this district may be considered as a further indication of the close relation of these various groups to each other, which surmise also agrees with Mr. Hughes' view about the relation of the Jabalpur group to the Maléri beds in this area.

*Brachyphyllum mamillare*, Lindl. and Hutt. Pl. III, figs. 2, 5. Exactly the same form as in the Jabalpur group of Jabalpur.

*Pachyphyll. peregrinum*, Schimp. Pl. III, figs. 7, 17, and figs. 4, 8, 16.

*Fruit cone*. Pl. III, fig. 20. Probably belonging to this species.

*Pachyphyllum*, sp. Pl. III, fig. 10.

*Echinostrobus rhombicus*, Fstm. Pl. III, figs. 6, 6a. Like the same originally described from Mr. Hacket's specimens.

*Araucaria latifolia*, n. sp. Pl. II, fig. 6. A broad-leaved form.

*Araucarites cutchensis*, Fstm. Pl. III, figs. 9, 11, 12-15, 19. The same form as known from other localities and groups.

*Araucarites macropterus* (?) Fstm. Pl. III, fig. 18.

*Ginkgo*, sp. Pl. III, fig. 1. One leaf.

<sup>1</sup> Gondwana Flora, Vol. II, pt. 2, 1878.



#### 4 FOSSIL FLORA OF THE GONDWANA SYSTEM IN INDIA.

CHANDIA, small nadi south of, South Rewah, Singwara district.

Collectio C. A. Hacket, 1872.

1877. Feistmantel: Flora of the Jabalpur group, Gondwana Flora, Vol. II, pt. 2. (Pal Ind., IX, 2.)

1880. *Idem*: Rec. Geol. Surv., India, Vol. XIII, pl. III, p. 190.

*Asplenium whitbyense*, Heer (including *Alethopt. indica*, O. M.). A small specimen not mentioned in my Jabalpur flora, found subsequently, figured now Pl. I, fig. 11.

*Sagenopteris* ? sp. Fstm. Jabalpur Flora, l. c., p. 10, Pl. III, fig. 6.

*Podozamites lanceolatus*, Lindl. and H. Jabal fl., l. c., p. 11, Pl. III, figs. 7, 8, 11, 12.

*Podozam. spathulatus*, Fstm. Var. Jab. fl., l. c., p. 12, Pl. IV, figs. 11, 12.

*Araucarites cutchensis*, Fstm. Jab. fl., l. c., p. 16, Pl. XIV, figs. 11-13.

*Echinostrobus expansus*, Schimp. Jab. fl., p. 17, Pl. XI, fig. 5.

*Echinostrobus rhombicus*, Fstm. Jab. fl., p. 18, Pl. XI, figs. 6-11.

CHANDIA, south-east of, near Barwar.

Collectio Hughes, 1881.

*Podozamites lanceolatus*, Lindl. and H. The usual form.

*Echinostrobus rhombicus* (?) Fstm. Fragments of branchlets.

*Araucarites cutchensis*, Fstm. Pl. XII, fig. 5.

I have also, together with these specimens from South Rewah, figured a few others, representing two species from near Jabalpur, from the same group. They are—

*Asplenium whitbyense*, Heer (as *Al. indica*), Pl. I, fig. 10.

*Alethopteris medicottiana*, Fstm. Pl. I, figs. 12, 13.

UMRAR RIVER, from above Buragaon, north of Chandia, in dark carbonaceous shale.

Collectio Hacket, 1872.

*Gleichenia rewahensis*, n. sp. Pl. XX, figs. 7-9.

*Ptilophyllum cutchense*, Morr.

SANDBAH RIVER, tributary of Son-Mahanadi Deori (Khamtara), about  $7\frac{1}{2}$  miles south-west of Kouria.

Collectio Hughes, 1882.

*Podozamites lanceolatus*, L. and H. Numerous leaves.

*Brachyphyllum mamillare*, Bgt. One specimen represents a pretty thick stem.

The fossils are preserved in a rock just like that of the Jabalpur group of the Sâtpura basin, a buff, soft clayey shale.

The fossils of the Jabalpur group in South Rewah are thus, on the whole, of about the same character as those from the same group in the Sâtpura basin, though we must notice the rare occurrence of *Ptilophyllum* and the absence of *Pterophyllum*. On the other hand there is an important addition to this South Rewah Jabalpur flora in *Taxites planus*, which occurred rather frequently at Bansa, together with numerous other fossils.

## • MALERI BEDS, 1859; 1876.

The identification of this horizon in South Rewah is of great importance, containing as it does very nearly the same animal remains as in the original locality in the Central Provinces, because it is probable that its relation to the other members of the Upper Gondwanas may be made out here with more precision than was possible in the Central Provinces. Mr. Hughes has not passed any decided opinion yet about this relation, but from his first note on the South Rewah Gondwana<sup>1</sup> basin it would appear that he does not believe these Maléri beds to be much older than the Jabalpur group.

TIKI, about 6 miles south of Beohari, long. 81° 25' E.; lat. N. 23° 56'.

*Collectio Hughes*, 1880.

1880. Feistmantel: *Rec. Geol. Surv., India*, Vol. XIII, Pt. III, pp. 188-189.

1881. Hughes: *ib.*, Vol. XIV, Pt. I, pp. 136-137.

1881. Lydekker: *ib.*, Vol. XIV, Pt. II, p. 176.

*Parasuchus*, sp. Represented by portions of jaws, several teeth, numerous fragments of dermal scutes, vertebrae and other bones. In my note on the South Rewah fossils I quoted these remains as *Parasuchus hislopi* (Huxley Mss.) from a cursory comparison of these South Rewah bones with the *Parasuchus* remains from the Central Provinces, to which their occurrence together with, as it appears, the same *Hyperodapedon* and with *Unio* gave some support. Mr. Lydekker, however, who examined the remains more carefully, expressed his belief (*l. c.*) that my identification was somewhat mistaken, indicating some characters which he considers to require specific distinction.

*Hyperodapedon*, sp. Jaws apparently of the same animal as that of the Central Provinces, but three of the jaws larger than any hitherto known from the latter place.

*Unio*, sp. Several specimens of a small species. Unios are also mentioned by the late Rev. Mr. Hislop<sup>2</sup> in association with similar bones near Maléri, C. Provinces.

## B.—TRANSITIONÉL BEDS.

(? MIDDLE GONDWANAS.)

The hitherto generally used division of the Gondwana system into an upper and lower portion appears to become more and more insufficient. From Mr. H. B. Medlicott's notes on the Sâtpura basin<sup>3</sup> we learn that there is conformity between the various stages, and as the horizon between the two divisions is occupied by a thick series of beds without any distinct fossils, it is more or less difficult to draw a correct line of separation between "Upper" and "Lower." At the same time we know that in the Auranga coal-field, on the northern face of the Latiahar hill, certain red shales, which, according to petrological conditions, would be considered as belonging to the Mahâdevas<sup>4</sup> (Upper Gondwanas), contain most decidedly lower

<sup>1</sup> *Rec. Geol. Surv., India*, Vol. XIV, Pt. 1, p. 133.

<sup>2</sup> *Quar. Jour. Geol. Soc., London*, Vol. XX, 1864, p. 281.

<sup>3</sup> *Mem. Geol. Surv., India*, Vol. X.

<sup>4</sup> Ball: *Mem. Geol. Surv., India*, Vol. XV, Pt. 1, p. 89. *Fstun*: *Rec. Geol. Surv., India*, Vol. XIV, Pt. 3, pp. 158-26

Gondwana fossils, such as *Vertebraria*, *Glossopteris* and *Schizoneura*. The case is similar in South Rewah, where it is more strongly expressed than elsewhere. There are certain beds, known at two localities at least, which, judged from a stratigraphical and lithological point of view, would be taken to belong to the Mahadeva horizon, while the fossils are of the Lower Gondwana division. To provide for these doubtful cases, and to comprise such beds on the boundary between the two former chief divisions with an Upper Gondwana aspect but with Lower Gondwana fossils, the above sub-division is proposed. It is meant in the first instance to affect the Gondwana system in South Rewah only, but it might eventually with the same advantage be extended to other Gondwana basins also, as in the two instances already mentioned.

PARSORA, near Beli, about 6 miles north-north-east of Páli.

*Collectio* Hughes, 1880 and 1882.

1880. Feistmantel: *Rec. Geol. Surv., India*, Vol. XIII, pt. 3, pp. 187-188.

1881. Hughes: *ib.*, Vol. XIV, pt. 1., pp. 132-136.

*Danaopsis Hughesi*, Fstm. Pls. IV-VII; VIII, figs. 1, 5; IX, fig. 4; X, &c.

Specimens were sent by Mr. Hughes in 1880 and 1882.

*Thinnfeldia* (comp.) *odontopteroides*, Morris, sp. Pl. VIII, figs. 4, 6, 7; XX, fig. 5.

*Asplenium whitbyense*, Heer (*Alethopt. Indica*, O. M.), Pl. VIII, figs. 2, 3.

*Nöggerathiopsis histopi*, Fstm. Pl. IX, figs. 1-3.

Amongst the fossils from this place sent by Mr. Hughes in 1881 there is a leaf  $6\frac{1}{2}$  inches long and  $\frac{3}{4}$  inch broad, somewhat curved, traversed by longitudinal veins, about  $\frac{3}{4}$  line apart; they are not very distinct, but so much appears to me certain that they do not originate by dichotomy from basal veins, and it seems to me very probable that this leaf is of *Schizoneura*.

In my first note on the South Rewah Gondwana fossils (*l. c.*), I thought that from the above association of fossils, especially from the occurrence of *Nöggerathiopsis*, it would be best to class this locality in the Lower Gondwanas, with the Panchet group, judging from the occurrence of the genus *Danaopsis* and of *Thinnfeldia* comp. *odontopteroides*, which latter I have identified before from beds, apparently Panchets, in the Ramkola coal-field. But as Mr. Hughes, in his above note, was more in favour of the Mahadeva horizon I have placed this locality in the above new division.

DAIGAON, on the Johilla river; about 4 miles north-west of Páli.

*Collectio* Hughes, 1880, 1881 and 1882.

1880. Feistmantel: *l. c.*, p. 187.

1881. Hughes: *l. c.*, p. 128 and pt. 4, p. 319.

The specimens of 1880 and 1881 represented only one species.

*Vertebraria indica*, Royle; in fine grained, reddish sandstone. Pl. XI, fig. 1.

This year (1882) the fossils represented were—

(a) In fine sandy, somewhat micaceous shale, of yellowish-brown, passing into red-brown colour; the leaf impressions somewhat darker.

*Glossopteris communis*, Fstm.

(b) In earthy shale, with small flakes of mica, of a grey colour with olive-greenish tints.  
*Glossopt. indica*, Schimp.  
*Vertebraria indica*, Royle.

In my first note on the South Rewah fossils (*l. c.*), having no other evidence before me but the occurrence of *Vertebraria*, I considered this locality as belonging to the Lower Gondwána portion. Mr. Hughes, however, advocates distinctly a higher position for these beds. In his first note (*l. c.*) he classed these sandstones provisionally with the Raniganj group, though he was at first inclined to class them with a series higher than that of the Damudas, remarking that "without the fossil (*Vertebraria*) I should certainly have referred the rocks in the Johilla river (between Bara and Chota Daigaon) to a higher horizon." In his second note (*l. c.*, p. 319), he again notices the occurrence of *Vertebraria* at the junction of the Bara Daigaon nala, and the Johilla river, and says: "This discovery might lead one to suppose that the sandstones here ought to be classed as Damudas, but their physical aspect is utterly at variance with that of the Damuda type. The presence of *Vertebraria* is the difficulty so long as it is looked upon as a specific plant of the Damuda series. I would dismiss the difficulty by extending the range of *Vertebraria*."

The difficulty of properly classing this locality is now increased by the specimens lately sent from them by Mr. Hughes, amongst which *Glossopteris* is largely represented. It will perhaps be met by including this locality also into the division of "Transitional beds" (Middle Gondwánas).

### C.—LOWER GONDÁWNAS.

This division comprises all the beds, lower than any of those hitherto named, and which contain fossils of the same character as that of the Lower Gondwána fossils in other basins. I do not think there are any beds of a higher horizon than the Raniganj group, at least the fossils do not indicate one.

#### RANIGANJ GROUP.

I shall describe the localities according to the two great areas in which they are situated.

#### A.—GOPAT AREA.

This area includes the localities in the vicinity of the Gopat river, and answers to what formerly was known under the term South Rewah.

BAJBAL, 2 miles west of Gopat river, lat. 24° 4' N., and long. 81° 57' E.

*Collectio* Hughes, 1880.

1880. Feistmantel: *l. c.*, p. 184.

1881. Hughes: *l. c.*, p. 130.

*Schizoneura gondwanensis*, Fstm. Just like the same form from the typical Raniganj group, Raniganj coal-field. Pl. XI, figs. 6, 8.

*Vertebraria indica*, Royle. Very numerous. Pl. XI, figs. 2-4.

*Glossopteris communis*, Fstm. Pl. XII, figs. 1, 1a.

*Glossopt. indica*, Schimp. Pl. XII, figs. 4, 4a.

*Glossopt. angustifolia*, Bgt.

*Squama*. Pl. XII, fig. 2.

CHANDRIDOL, about 8 miles west-north-west of Bajbai, and about 3 miles west of Marhwas.

*Collectio Hughes, 1880.*

1880. Feistmantel: *l. c.*, p. 184.

1881. Hughes: *l. c.*, p. 130.

*Schizoneura gondwanensis*, Fstm. The typical form.

*Glossopteris formosa*, Fstm. Described first from the Raniganj group, Raniganj coal-field.

MAHAN RIVER (tributary of Gopat river), between Minarra (Minhara) and Gaja (Ganjar), lat. 81° 58' N., and long. 81° 58' E.

*Collectio Hughes, 1880.*

1880. Feistmantel: *l. c.*, p. 184.

1881. Hughes: *l. c.*, p. 130.

*Schizoneura gondwanensis*, Fstm. Typical Raniganj form.

*Glossopteris communis*, Fstm.

*Glossopt. angustifolia*, Bgt.

*Alathopteris* comp. *Asplenium whitbyense*, Heer. A few pinnulæ, which as such I cannot distinguish from the above species.

*Angiopteridium*. Two fragments of a *taniopteroid* plant, resembling a similar one in the Kamthi beds of Nagpur area, which I quoted as *Angiopteridium* comp. *McClellandi*, O. M.

MAHAN RIVER, near Minarra.

*Collectio Hughes, 1880.*

1880. Feistmantel: *l. c.*, p. 185.

1881. Hughes: *l. c.*, p. 130 (para. 3 b.)

*Schizoneura gondwanensis*, Fstm. Typical form.

*Glossopteris communis*, Fstm.

*Glossopteris indica*, Schimp.

*Glossopt. retifera*, Fstm. Raniganj form.

*Glossopt. angustifolia*, Bgt.

*Alathopteris* comp. *Asplenium whitbyense*, Heer. Same as in preceding locality.

MAHAN RIVER, near Tansar, close to junction with Gopat river, north of preceding locality.

*Collectio Hughes, 1880.*

1880. Feistmantel: *l. c.*, p. 185.

1881. Hughes: *l. c.*, p. 130 (3 a.)

*Vertebraria indica*, Royle.

*Glossopteris*, sp.

PARASI, west of, from stream running between Parasi and Kunjwar, about 5 miles east of Gopat river, lat.  $24^{\circ} 2' E.$ , long.  $82^{\circ} 7' N.$

to Hughes, 1880.

1880. Feistmantel: *l. c.*, p. 185.

*Glossopteris*, sp. Fragmentary.

UNCERTAIN, presumably the Gopat area; spot not defined.

Collectio J. G. Medlicott, 1861.

1880. Feistmantel: *Pal. Ind. Gondwana Flora*, Vol. III, Pl. II, p. 12.

1880. *Idem*: *Rec. Geol. Surv., India*, Vol. XIII, Pl. III, p. 185.

A small series of plants amongst our older Gondwana collections is labelled South Rewah. In my Damuda flora (*l. c.*) these plants were referred to the northern part (Gopat area) of the South Rewah basin, as at the time when Mr. J. G. Medlicott collected these fossils the Rewah State did not extend to Sohágpur. From the appearance of the rocks and from the general character of the fossils, I have, in spite of the occurrence of *Voltzia*, classed them with the Raniganj group. Similar fossils in a very similar rock were collected by Mr. Hughes in the southern part of the basin (in the Sohágpur district), where they, however, appear to belong to a lower horizon. From the Gopat area Mr. Hughes did not collect anything like those specimens of Mr. J. G. Medlicott, and it therefore yet remains uncertain whether these fossils are really from the Gopat area, and if so, whether they also do not belong to a lower horizon.

For the present, however, I leave them doubtfully with the Raniganj group. They are—

*Vertebraria indica*, Royle.

*Equisetaceous stems*.

*Glossopteris communis*, Fstm.

*Nöggerathiopsis hislopi*, Bunbury (Fstm). Rather numerous. *Pal. Ind.*, *l. c.*, Pl. XLVA, figs. 1-5.

*Voltzia heterophylla*, Bgt. *Pal. Ind.*, *l. c.*, Pl. XLVIA, figs. 19-20.

Small seeds, probably of the preceding species.

#### B.—SOHÁGPUR AREA.

First are enumerated those localities from which fossils have recently been sent by Mr. Hughes. The specimens differ in petrographical character from the true Raniganj group, but the fossils do, I think, represent that group. Then follow some other places more or less in the vicinity of Sohágpur, and lastly those on the Son river.

GHOGRI, near deserted site of, about 4 miles north-north-west of Páli; about lat.  $23^{\circ} 25' N.$ , and long.  $81^{\circ} 4' E.$

Collectio Hughes, 1882.

*Glossopteris communis*, Fstm.

## 10 FOSSIL FLORA OF THE GONDWANA SYSTEM IN INDIA.

KARKOTI and MALHADU, hill between, about 3 miles north-east of Páli.

*Collectio Hughes, 1882.*

Fossils in slightly sandy shale, of red-brown colour; very ferruginous.

*Equisetaceous stem* (Schizoneura?).

*Sphenopteris polymorpha*, Fstm.

*Glossopteris communis*, Fstm.

*Glossopt. cordata*, n. sp. Pl. XX, fig. 1.

*Seeds.*

KURABAR, about  $3\frac{1}{2}$  miles east of Páli.

*Collectio Hughes, 1882.*

*Vertebraria indica*, Royle.

*Schizoneura*? stem.

*Sphenopteris polymorpha*, Fstm.

*Glossopteris communis*, Fstm.

*Glossopt. damudica*, Fstm.

MURCHA PASS, near Ganjra, about 8 miles east of Páli, about lat.  $23^{\circ} 20'$  N., long.  $81^{\circ} 14'$  E.

*Collectio Hughes, 1882.*

Fossils in micaceous sandy shale of red-brown colour, very ferruginous; the impressions darker. Some specimens harder and darker, with a purplish tint and numerous plant-fragments.

*Glossopteris communis*, Fstm.

AMLIHA, near Maiki,  $3\frac{1}{4}$  miles north-east of Sohágpur.

*Collectio Hughes, 1882.*

*Glossopteris communis*, Fstm.

*Glossopt. angustifolia*, Bgt.

*Small seeds.*

Fossils in grey, reddish, thin-bedded shale.

BANRAKACHAR, from base of hill near, 35 miles east of Sohágpur, 6 miles west of Ninguani.

*Collectio Hughes, 1882.*

*Vertebraria indica*, Royle. Stems and branched specimens.

Fossils in sandy, micaceous shale, olive-greenish, mottled reddish.

CHIRAI PANI, hill north of, about 10 miles south-east of Jaitpur (this latter  $27\frac{1}{2}$  miles north-east of Sohágpur.)

*Collectio Hughes, 1882.*

*Glossopteris*. Various species.

*Glossopt. communis*, Fstm.

*Glossopt. indica*, Schimp.

*Glossopt. damudica*, Fstm.

Fossils in highly ferruginous shale, densely filling the rock.

DIAPIPAR, about 1 mile south-east of, 9 miles north-north-east of Sohágpur.

*Collectio* Hughes, 1882. (Sub-Assistant Hira Lal.)

*Glossopteris communis*, Fstm.

Fossils in yellowish, brownish, grey, earthy shale.

HARRI (Sohágpur), about 7 miles south-east of Sohágpur.

*Collectio* Hughes, 1882.

*Vestabraria indica*, Royle.

*Glossopteris communis*, Fstm.

*Scales*, like some of the same kind from the Raniganj group elsewhere.

Fossils in grey, fine shale, with reddish tints.

KACHODHAR, about 11 miles west of Sohágpur.

*Collectio* Hughes, 1880 and 1882.

1880. Feistmantel: *l. c.*, p. 185.

1881. Hughes: *l. c.*, p. 132.

*Glossopteris communis*, Fstm. With fructification (1882). Pl. XXI, figs. 13, 14.

*Glossopt. stricta*, Bunb. Pl. XXI, fig. 11.

KEDOUNDI (Jaitpur); South Rewah, 4 miles north-east of Jaitpur, Sohágpur district.

*Collectio* Hughes, 1882.

*Glossopteris communis*, Fstm.

Fossils in grey, somewhat sandy shale.

KICHRI, west-north-west of, base of hill about  $6\frac{1}{2}$  miles east of Jaitpur, Sohágpur district.

*Collectio* Hughes, 1882.

*Glossopteris communis*, Fstm. And fragments of other species.

Fossils in highly ferruginous shale.

KUNUK, opposite the village Galhatha, 3 miles south-east of Jaitpur, Sohágpur district.

*Collectio* Hughes, 1882. (Sub-Assistant Hira Lal.)

*Schizoneura gondwanensis*, Fstm. Some good specimens.

*Glossopteris communis*, Fstm.

Fossils in grey, olive-greenish shale.

MURNA river, near Sohágpur, on the road to Páli.

*Collectio* Hughes, 1882. (Collected by Sub-Assistant Hira Lal.)

*Trizygia speciosa*, Royle. The first specimens known from South Rewah—the same form as from the Raniganj coal-field.

*Glossopteris communis*, Fstm.

*Glossopt. formosa*, Fstm. Like the same species from the Raniganj coal-field.

RICHAI hill, near Mahroi,  $4\frac{1}{2}$  miles west of Sohágpur.

*Collectio* Hughes, 1882.

*Glossopteris*, sp. Fragments.



SIMARIA (on the Atlas Sheet : Simarha), in lat.  $23^{\circ} 11' N.$ , and long.  $81^{\circ} 24' E.$

*Collectio Hughes, 1881.*

*Equisetaceous stems (Phyllothea or Schizoneura).*

*Glossopteris communis*, Fstm. Large form.

SOHÁGPUR, Sohágpur district (Rewah).

*Collectio Hughes, 1881.*

*Vertebraria indica*, Royle.

SOHÁGPUR, in Rewah.

*Collectio J. G. Medlicott, 1861.*

1880. Feistmantel : Pal. Ind. Gondwana Flora, Vol. III, Pl. II, p. 13.

1880. Feistmantel : Rec. Geol. Surv., India, Vol. XIII, p. 186.

*Vertebraria indica*, Royle (Pal. Ind., l. c., Pl. XIVA, bis., fig. 3).

*Glossopteris communis*, Fstm.

*Glossopt. browniana*, Bgt. (Pal. Ind., l. c., Pl. XLA, fig. 5).

*Glossopt. damudica*, Fstm. (Pal. Ind., l. c., Pl. XLA, fig. 6).

CHAURI, CHOTA, on the Son river, about long.  $81^{\circ} 20' E.$ , lat.  $23^{\circ} 30' N.$

*Collectio Hughes, 1882.*

*Schizoneura*, sp. A portion of a leaf, the substance of which is preserved as a thin coal-film, and which is traversed by the thicker and thinner lines, belongs, I believe, to *Schizoneura*.

*Vertebraria indica*, Royle.

*Glossopteris communis*, Fstm.

*Glossopt. indica*, Schimp.

*Glossopt. formosa*, Fstm.

The impressions are preserved partly in earthy micaceous shale and partly in earthy limestone.

GURARU, on the Son river, about long.  $81^{\circ} 23' E.$ , and lat.  $23^{\circ} 28' N.$

*Collectio Hacket, 1872.*

*Collectio Hughes, 1880 and 1882.*

1880. Feistmantel : Pal. Ind., l. c., Vol. III, Pt. II, p. 13.

1880. *Idem* : Rec. Geol. Surv., India, Vol. XIII, Pt. III, p. 186.

1881. Hughes : l. c., Vol. XIV, Pt. I, p. 132.

It is now established beyond any doubt that the specimens collected by Mr. Hacket in 1872 were from the same locality as those collected subsequently by Mr. Hughes, and to avoid repetition I quote all together :—

(a) Fossils in dark shale, with a greenish tint :—

*Vertebraria indica*, Royle (Hacket and Hughes).

*Schizoneura gondwanensis*, Fstm. (Hughes). Figured on Pl. XIX.

*Macrotæniopteris*, Fstm. (Hacket). Like the same species from the Nágpúr area, Pl. XXI, fig. 5.

*Glossopteris communis*, Fstm. (Hacket and Hughes). Amongst Mr. Hughes' specimens there is also the large form of this species as known from the Jharia coal-field.

*Glossopteris indica*, Schimper (Hughes). One specimen resembles very much *Gl. browniana*, Bgt; but the network becomes very narrow in the upper part and the apex is pointed.

*Glossopt. formosa*, Fstm. (Hughes).

*Glossopt. formosa*, var. *major*, Fstm. (Hughes). Pl. XXI, fig. 12.

*Glossopt. browniana*, Bgt. (Hughes). Pl. XX, fig. 3.

*Squama gymnospermorum?* (Hughes). (See Pal. Ind., l. c., Pl. XLVIIa, figs. 2-3.)

*Dictyopteridium*, sp. (Hackett). (Figure *ibid*, Pl. XLIIa, fig. 5.)

(b) Fossils in light yellowish-grey shale, collected by Mr. Hughes.

*Glossopteris angustifolia*, Bgt.

SON RIVER, opposite deserted village of Sarsi.

*Collectio* Hughes, 1880. (Sub-Assistant Hira Lal.)

1880. Feistmantel: Rec. Geol. Surv., India, Vol. XIII, Pt. 3, p. 186.

*Schizoneura gondwanensis*, Fstm. Pl. XIII, fig. 1.

*Glossopteris browniana*, Bgt.

SON RIVER, near its junction with the Murna stream.

*Collectio* Hughes, 1881.

1881. Hughes: Rec. Geol. Surv., India, Vol. XIV, Pt. 4, p. 318.

*Dicksonia hughesi*, Fstm. Pl. XII, fig. 3.

*Glossopteris angustifolia*, Bgt.

*Glossopt. communis*, Fstm.

The sandy shale in which these plant-remains are preserved looks very much like the same rock from the locality Guráru.

### BARAKAR GROUP.

I include under this heading besides several localities which apparently belong to this group, also a few others, the fossils of which, in my opinion, have a certain resemblance to those of the Karharbári beds. It may perhaps be that one or the other of the preceding localities will on stratigraphical grounds have to be classified with this group, but this would not be of much consequence, because these two groups do not seem to be widely separated in the South Rewah basin.

AMLIHA river, between Dongra and Tumibar, nearly 8 miles south-east of Khaira.

*Collectio* Hughes, 1882.

*Glossopteris communis*, Fstm.

Fossils in reddish-white sandy shale.

AMGAR, near, about 11 miles south-east of Páli; long. 81° 16' E., lat. 23° 18' N.

*Collectio* Hughes, 1881. (Hira Lal.)

*Glossopteris*, sp. Fragmentary specimens. No other fossils were procured.

# 14 FOSSIL FLOA OF THE GONDWANA SYSTEM IN INDIA.

CHATAN, about  $\frac{3}{4}$  mile north of Umaria; lat.  $23^{\circ} 33' N.$ , long.  $80^{\circ} 54' E.$

*Collectio* Hughes, 1882.

*Vertebraria indica*, Royle:

*Glossopteris angustifolia*, Bgt.

Fossils in buff shale intermixed with white sandstone.

DHOBGATA nadi, south of deserted site of Khodargaon and KUDRI, about 5 miles south-west of Páli.

I quote these two localities together, as their geographical position is so very close that they really coincide.

*Collectio* Hughes, 1882. (Those from Kúdri were collected by Sub-Assistant Hira Lal.)

Fossils in light yellowish-grey, earthy shale.

*Vertebraria indica*, Royle (Dhobgata stream).

*Glossopteris communis*, Fstm. (Kúdri).

*Glossopt. indica*, Schimp. (Dhobgata stream).

*Glossopt. browniana*, Bgt. (Dhobgata stream).

*Glossopt. dumudica*, Fstm. (Dhobgata stream).

*Gangamopteris*, sp. (Kúdri).

*Nöggerathiopsis hislopi*, Fstm. (Kúdri).

DUMARKACHAR, about 28 miles east (somewhat by north) of Anukpur; long.  $82^{\circ} 10' E.$ , lat.  $23^{\circ} 10' N.$

*Collectio* Hughes, 1881.

*Glossopteris communis*, Fstm.

*Gangamopteris cyclopteroides* (comp. *obliqua*—McCoy).

Reminds somewhat of Karharbári beds.

MANGTAR, about  $4\frac{1}{2}$  miles south of Páli, Sohágpur district.

*Collectio* Hughes, 1881.

*Gangamopteris cyclopteroides*, Fstm.

*Nöggerathiopsis hislopi*, Fstm.

Might possibly represent Karharbári beds.

PÁLI and JOHILLA rivers, junction of, near Páli.

*Collectio* Hughes, 1880.

1880. Feistmantel: Rec. Geol. Surv., India, Vol. XIII, pt. 3, pp. 183-184.

1881. Hughes: *ib.*, Vol. XIV. pt. 1, pp. 126-127.

*Glossopteris communis*, Fstm. Of the usual type.

*Gangamopteris* comp. *cyclopteroides*, Fstm.

*Nöggerathiopsis hislopi*, Fstm. Pl. XIII, figs. 2-4; XVII, 4; XVIII, 1.

It was this locality which I at first assigned to the Karharbári beds, though not definitively. Mr. Hughes, however, in his first note (*l. c.*, p. 126), says that, "looking at the beds apart from their botanical contents, they will pass muster as Barákars."

So I quote this locality here with the Barákars.

## KARHARBÁRI BEDS.

I feel justified, at least with regard to the fossils, in introducing here this division. I had at first contemplated, especially in consequence of Mr. Hughes' views, to include some of the localities contained under this heading, also under the heading Barákar group; but as I am here giving only the palæontological results, as derived from the examination of the plant fossils, it is, I think, better to class the localities as is suggested from this point of view. Should it, however, happen that Mr. Hughes' geological researches should demand forcibly the classification of some of the localities with the Barákar group, there will be no strong objection to effecting the transfers, as the step from the Karharbári beds to the Barákar group is by no means a large one.

In quoting the localities under this heading I place those first where the characters of the Karharbári beds are less marked than in the others.

UMERIA, about 17 miles north-west of Páli; longitude  $80^{\circ} 54'$  E., latitude  $23^{\circ} 32'$  N.

*Collectio* Hughes, 1881 and 1882.

In Mr. Hughes' first note on the South Rewah Gondwana basin he adopts provisionally the view suggested by previous cursory survey that the Umeria beds were in the Jabalpur group; but the subsequent discovery of Lower Gondwana plants made it certain that this was not the case. (Hughes, *l. c.*, Vol. XIV, pt. 4, p. 314.)

*Glossopteris communis*, Fstm.

*Gangamopteris*, sp. (1882).

*Nöggerathopsis hislopi*, Fstm.

UMERIA-KALESAR, position nearly same as above.

*Collectio* Hughes, 1882.

*Glossopteris communis*, Fstm. Top portion.

*Gangamopteris cyclopteroides*, var (?) *attenuata*.

Fossils in light-grey earthy shale.

The following localities require special notice:—

KHAIRA, about 12 miles south-east of Sohágpur.

To avoid repetition I comprise under this head the fossils from three places in the immediate neighbourhood of this locality, and which there is little doubt belong all to the same horizon:—

(a) Hardi,  $2\frac{1}{2}$  miles south-west of Khaira, about 15 miles south-east-south of Sohágpur; longitude  $81^{\circ} 30'$  E., latitude  $23^{\circ} 6'$  N.

*Collectio* Hughes, 1880.

# 16 FOSSIL FLORA OF THE GONDWĀNA SYSTEM IN INDIA.

- (b) Between Hardi and Sarangpur, about 2 miles south-south-west of Khaira; longitude  $81^{\circ} 31' E.$ , latitude  $23^{\circ} 9' N.$

*Collectio Hughes, 1881.*

- (c) Dhamni, about 2 miles east of Khaira; longitude  $81^{\circ} 32' E.$ ; latitude  $23^{\circ} 7' N.$

*Collectio Hughes, 1881 and 1882.*

- (d) Sarangpur, about 2 miles south of Khaira.

*Collectio Hughes, 1882.*

From the analogy of the Hardi fossils with those collected by Mr. J. G. Medlicott in South Rewah (probably Gopat area), and which I classed with the Raniganj group, I at first placed the Hardi fossils also with the same group, as there was then nothing in particular which might have demanded another classification. But subsequent discoveries of more numerous and varied fossils, by Mr. Hughes, showed distinctly that these fossils must occupy a lower horizon, and it appeared to me that they might rather be included with the Karharbári beds than with any other. But here Mr. Hughes' view somewhat differs, who could not see anything distinctive in the character of the rocks containing this partial Karharbári flora, to warrant a separation from the Damudas (Rec. Geol. Surv., India, Vol. XIV, pt. 4, p. 313).

I still think it best to leave them for the present with the Karharbári beds.

The fossils are—

*Vertebraria indica*, Royle. Hardi.

*Glossopteris communis*, Fstm. Hardi and between Hardi and Sarangpur, at Sarangpur (1881).

*Gangamopteris cyclopteroides*, Fstm. Between Hardi and Sarangpur, at Sarangpur.

*Gangamopt. spathulata*, Fstm. Pl. XV, figs. 12-13. Between Hardi and Sarangpur.

*Anomozamieta?* two leaflets (1882), Sarangpur.

*Nöggerathiopsis hislopi*, Fstm. (Bunb. sp.). Hardi, Dhamni, Pls. XIV, XV; fig. 4b; Sarangpur.

*Nöggerathiopsis lacerata*, n. sp. Pl. XV, figs. 1—3, 4a; Pl. XVII, figs. 2, 3. From Dhamni.

*Foltzia heterophylla*, Bgt. Hardi and between Hardi and Sarangpur, at Sarangpur.

*Carpolithes milleri*, Fstm. Pl. XV, figs. 5—12. Dhamni.

This is the same as was at first described by me from the Karharbári beds in the Karharbári coal-field.

*Samaropsis*, comp. *parvula*, Heer. Hardi. *Squamæ*, Dhamni.

PINAORA, South Rewah, Sindwara ilāka.

*Collectio Hughes, 1882.*

Amongst the fossils recently sent down from South Rewah by Mr. Hughes, there are several from a locality which I think ought to be classed with the Karharbári beds, if we take their general character into consideration.

*Glossopteris indica*, Schimp.

*Glossopt. tanioides*, n. sp. Pl. XXI, figs. 4, 9.

*Glossopt. angustifolia*, Bgt.

*Gangamopteris angustifolia*? McCoy. Pl. XXI, fig. 3.

*Gangamopt. cyclopteroides*, var. *attenuata*. Fstm. Pl. XXI, fig. 7.

*Gangamopt. subauriculata*, Fstm. Pl. XXI, fig. 1.

*Samaropsis*, comp. *parvula*, Heer. Pl. XXI, fig. 2.

*Nöggerathiopsis hislopi*, Fstm. Pl. XXI, figs. 6, 8, 10.

This is an association of fossils corresponding best with that of the second and third Karharbári seam of the Karharbári coal-field.

#### TALCHIR GROUP.

Mr. Hughes made also a few additions to the localities with Talchir fossils, and we get thus a much wider geographical distribution of Talchir fossils than hitherto known.

ANUKPUR, west of, in the river, Sohágpur district; 26 miles south-east of Sohágpur; longitude  $81^{\circ} 43'$  E., latitude  $23^{\circ} 7'$  N.

*Collectio* Hughes, 1881.

Fossils in soft, light olive-green, yellowish clayey shale.

*Gangamopteris cyclopteroides*, Fstm. Like the type form from the Karaun coal-field. Pl. XVI, figs. 1, 2, 3, 4a.

*Gangamopt. cyclopteroides*, var. *attenuata*, Fstm. Pl. XVI, fig. 4b.

*Samaropsis*. Pl. XVI, fig. 4c.

ANUKPUR, about 2 miles north-east of, at the junction of the Tánki and Tipan rivers; longitude  $81^{\circ} 46' 5''$  E., latitude  $23^{\circ} 7' 5''$  N.

*Collectio* Hughes, 1881.

*Gangamopteris* comp. *spathulata*, McCoy. In a peculiar grey sandstone, with coal-films on the leaves.

BARERI, latitude  $23^{\circ} 34'$  N., longitude  $80^{\circ} 50'$  E., in river east of Bareri, ghât Murguri, north-west of Páli.

*Collectio* Hughes, 1882.

*Glossopteris*, sp.

*Gangamopteris major*, Fstm. Just like some from the Karharbári beds, Karharbári coal-field. Pl. XX, fig. 2.

*Gangamopt. cyclopteroides*, Fstm. Fragments and a small rounded leaf.

*Nöggerathiopsis hislopi*. Pl. XX, fig. 10.

BEHIA-BARGAON, from river south of, 18 miles north-east of Anukpur (this latter 26 miles south-east of Sohágpur).

*Collectio* Sub-Asst. Hira Lal.

*Vertebraria indica*, Royle. The first undoubted specimen from real Talchirs. In fine, light-yellowish, greenish shale.

GOBAIA, on the Johilla river, near Páli.

*Collectio* Hughes, 1880.

1881. Feistmantel: Rec. Geol. Surv., India, Vol. XIII, pt. 3, p. 183.

*Equisetaceous stem.*

# 18 FOSSIL FLORA OF THE GONDWANA SYSTEM IN INDIA.

It is evident that this locality could not have been placed in the Talchir on palæontological evidence; it was assigned to this group by Mr. Hughes himself.

ULSAR, about 1½ miles north-north-west of, in Nagdhadhar nadi, 27 miles east of Anukpur.

Collectio Hira Lal, 1882.

" *Gangamopteris cyclopteroides*, Fstm.

*Gangamopteris*, sp. Fstm.

Fossils in fine grained, olive-green sandstone.

*Systematical list of fossils with their distribution.*

NAMES.	UPPER GOND- WANAS.		DOUBT- FUL.	LOWER GONDWANAS.			
	Jabalpur group.	Malôri horizon.		Transi- tional.	Raniganj group.	Barâkar group.	Karhar- bâri beds.
PLANTÆ.							
EQUISETACEÆ.							
<i>Schizoneura gondwanensis</i> , Fstm. . . . .	-	-	-	+	-	-	-
<i>Trizygia speciosa</i> , Royle . . . . .	-	-	-	+	-	-	-
<i>Vertebraria indica</i> , Royle . . . . .	-	-	+	+	+	-	-
FILICES.							
Order: GLEICHENIACEÆ.							
<i>Gleichenia rawahensis</i> , N. M.) . . . . .	+	-	-	-	-	-	-
Order: MARATTIACEÆ.							
<i>Danaëopsis hughesi</i> , Fstm. . . . .	-	-	+	-	-	-	-
Order: CYATHEACEÆ.							
<i>Sphenopteris polymorpha</i> , Fstm. . . . .	-	-	-	+	-	-	-
<i>Dicksonia hughesi</i> , Fstm. . . . .	-	-	-	+	-	-	-
Order: POLYPODIACEÆ.							
<i>Asplenium whitbyense</i> , Hoer (including <i>Alethopt.</i> <i>indica</i> , O. M.) . . . . .	+	-	+	-	-	-	-
<i>Ditto</i> comp. <i>whitbyense</i> , Hoer . . . . .	-	-	-	+	-	-	-
<i>Alethopteris medicottiana</i> , Oldh. . . . .	+	-	-	-	-	-	-
Order: LOMATOPTERIDÆ AND PACHYPTERIDÆ.							
<i>Thinnfeldia</i> comp. <i>odontopteroides</i> , Morr., sp. . . . .	-	-	+	-	-	-	-
Order: TENIOPTERIDÆ.							
<i>Macroteniopteris feddeni</i> , Fstm. . . . .	-	-	-	+	-	-	-
<i>Angiopteridium</i> comp. <i>mc'Clellandi</i> , Schimp. . . . .	-	-	-	+	-	-	-
Order: DICTYOTENIOPTERIDÆ.							
<i>Glossopteris communis</i> , Fstm. . . . .	-	-	+	+	+	-	-

NAMES.	UPPER GOND- WANAS.		DOUBT- FUL.	LOWER GONDWANAS.			
	Jabalpur group.	Maléri horizon.	Transi- tional.	Raniganj group.	Barékar group.	Karhar- bâri beds.	Talchir group.
<i>Glossopt. indica</i> , Schimp.	—	—	+	+	+	+	—
<i>Glossopt. stricta</i> , Bunb.	—	—	—	+	—	—	—
<i>Glossopt. cordata</i> , n. sp.	—	—	—	—	—	—	—
<i>Glossopt. browniana</i> , Bgt.	—	—	—	—	+	—	—
<i>Glossopt. damudica</i> , Fstm.	—	—	—	+	+	—	—
<i>Glossopt. retifera</i> , Fstm.	—	—	—	+	—	—	—
<i>Glossopt. angustifolia</i> , Bgt.	—	—	—	+	+	+	—
<i>Glossopt. formosa</i> , Fstm.	—	—	—	+	—	—	—
<i>Glossopt. formosa</i> , var. <i>major</i> , nov.	—	—	—	+	—	—	—
<i>Glossopt. tanioides</i> , n. sp.	—	—	—	—	—	+	—
Order: Dictyopteridæ.							
<i>Gangamopteris cyclopteroides</i> , Fstm.	—	—	—	—	+	—	+
<i>Gangamopt. cyclopteroides</i> , var. <i>attenuata</i>	—	—	—	—	—	+	+
<i>Gangamopt. cyclopt.</i> var. <i>subauriculata</i>	—	—	—	—	—	+	—
<i>Gangamopt. major</i> , Fstm.	—	—	—	—	—	—	+
<i>Gangamopt. comp. angustifolia</i> , McCoy.	—	—	—	—	—	+	—
<i>Sagenopteris</i> ? sp.?	+	—	—	—	—	—	—
<i>Dictyopteridium</i> , sp.	—	—	—	+	—	—	—
CYCADEACEÆ.							
<i>Podzamites lanceolatus</i> , Lindl. and Hutton	+	—	—	—	—	—	—
<i>Podzamites</i> var. <i>spathulatus</i>	+	—	—	—	—	—	—
<i>Nöggerathiopsis hislopi</i> , Fstm. (Bunb. sp.)	—	—	+	+	+	+	+
<i>Nöggerathiopsis lacerata</i> , n. sp.	—	—	—	—	+	—	—
<i>Ptilophyllum cutchense</i> , Morr.	+	—	—	—	—	—	—
<i>Squamæ</i> ? <i>cycadeorum</i> ?	—	—	—	+	—	—	—
<i>Carpolithes milleri</i> , Fstm.	—	—	—	—	+	—	—
CONIFERÆ.							
<i>Voltsia heterophylla</i> , Bgt.	—	—	—	+	+	—	—
<i>Pallissya jabalpurensis</i> , Fstm.	+	—	—	—	—	—	—
<i>Araucarites cutchensis</i> , Fstm.	+	—	—	—	—	—	—
<i>Ar. macropterus</i> , Fstm.	+	—	—	—	—	—	—
<i>Araucaria latifolia</i> , n. sp.	+	—	—	—	—	—	—
<i>Pachyphyllum peregrinum</i> , Schimp.	+	—	—	—	—	—	—
<i>Pachyphyllum</i> , sp.	+	—	—	—	—	—	—
<i>Echinostrobus expansus</i> , Schimp.	+	—	—	—	—	—	—
<i>Echinostr. rhombicus</i> , Fstm.	+	—	—	—	—	—	—
<i>Brachyphyllum mamillare</i> , L. and H.	+	—	—	—	—	—	—



NAMES.	UPPER GOND- WANAS.		DOUBT- FUL.	• LOWER GONDWANAS.			
	Jabalpur group.	Maléri horizon.	Transi- tional.	Baniganj group.	Barákar group.	Karhar- bári beds.	Talohir group.
<i>Taxites planus</i> , Fstm. . . . .	+	—	—	—	—	—	—
<i>Gingko</i> , sp.* . . . . .	+	—	—	—	—	—	—
<i>Samaropsis</i> , sp. . . . .	—	—	—	—	+	+	+
<i>Seeds?</i> coniferous . . . . .	—	—	—	+	—	—	—
<b>ANIMALIA.</b>							
<b>LAMELLIBRANCHIATA.</b>							
<i>Unio</i> , sp. . . . .	—	+	—	—	—	—	—
<b>LACERTILIA.</b>							
<i>Hyperodapedon</i> , sp. . . . .	—	+	—	—	—	—	—
<b>CROCODILIA.</b>							
<i>Parasuchus</i> , sp. . . . .	—	+	—	—	—	—	—

### DESCRIPTION OF THE FOSSILS.

Although there is not a very great number of new species to be described in the following pages, yet the number of fossils altogether is considerable, and their record forms an important addition to our knowledge of the geographical, and partly also of the geological distribution of Gondwana fossils, which, though described from other Gondwana basins, have not been hitherto recorded from South Rewah. The fossils will be described in the same order as observed in the above general list, previously described species receiving naturally less attention, but for all their distribution will be equally detailed.

### PLANTÆ.

#### CRYPTOGAMÆ.

#### PTERIDOPHYTA.

##### EQUISETACEÆ.

Genus: SCHIZONEURA, *Schimp.* and *Moug.*, 1844.

1880. Feistmantel, Gondwana Flora, Vol. III, 2, p. 59.

The generical characters have been discussed sufficiently in the preceding volume; there is only one species known from the South Rewah basin, the same as that described from other places.

**SCHIZONEURA GONDWANENSIS**, *Fstm.* Pl. XI, figs. 6, 8; pl. XIII, fig. 1; pl. XX, fig. 6.

1880. Feistmantel, *l. c.*, p. 61, and numerous figures.

This species, which is known to be numerous in several of the other coal-fields, occurs also at various localities in the South Rewah basin. I figure only a few specimens, which show the same characters as those previously figured. Fig. 6 on Pl. XI is a single leaf, or more correctly a portion of the leafsheath, showing distinctly its composition of several lineal leaflets, traversed by a median rib (the thinner lines) and joined (or attached to each other) along the margin (the darker lines). It is of considerable length; the leaflets of the sheath are very narrow, and number in this one portion 13, so that for the entire sheath the number would be 26, a somewhat higher number than in the majority of cases. Fig. 8 on the same plate shows one of those instances where the sheath has split along the commissural line of the leaflets, showing the beginning of further splitting on one side. The specimen figured on Pl. XIII, fig. 1, represents two plants of rather a robust character, but otherwise the same as in the others; the stalks are pretty thick, the leafsheaths broad, showing six to seven leaflets; these are also somewhat broader than in the preceding specimens, and exhibit distinctly enough the median nerve (here the darker lines) as well as the attachment along the margin (the thinner lines). The stalk is striated, but does not exhibit the attachment of the sheath in the joints. These two specimens are somewhat of the same make as those figured in Vol. III, on Pl. IVA, fig. 3; Pl. VA, fig. 4; and Pl. VIIA, fig. 2.

A specimen exhibiting the more usual form is figured on Pl. XX, fig. 6; the sheath portions are oblongly ovate, of smaller size, exhibiting nine to ten leaflets, with their median ribs and lines of attachment visible. It resembles many of the figs given in my Flora of the Damuda and Panchet divisions (*l. c.*).

*Occurrence in the South Rewah basin.*—This species is here limited to one horizon, though rather widely distributed.

*Raniganj group.*—Bajbai,<sup>1</sup> on the Gopat river (Hughes, 1880), Pl. XI, figs. 6, 8; Chanduidol (Hughes, 1880); Mahan river between Minarra (Minhara); Gaja (Ganjar) (Hughes, 1880); Son river near Guráru (Hughes, 1880 and 1882), Pl. XX, fig. 6; Son river opposite Sarsi (Hughes, 1880), Pl. XIII, fig. 1; Chota Chauri on the Son, fragmentary (Hughes, 1882); Kunuk (1882), Sohágpur district.

*Schizoneura* does therefore occur in the South Rewah basin under the same circumstances and on the same horizon as in the Bengal coal-fields, from where it was first made known; and in fact its frequent occurrence in the first-named basin was a great help in deciding the horizon of the beds in which it was found. Its occurrence in this basin is at the same time a further illustration of its geographical distribution, linking in this respect the Bengal coal-fields with the Sápura basin.

<sup>1</sup> For the position of the localities see the preceding pages.

We now know plants from almost all the coal-fields which have been surveyed, and it is interesting to find that *Schizoneura*, though having a very wide distribution, yet keeps to a certain set of coal-fields. We find it in the coal-fields of the Damúda valley (Raniganj, Jharia, Bokáro, and Káranpúra coal-fields), and in the Karharbári coal-field; further westwards, in the Auranga, Ramkola, and Tatapáni coal-fields (Sírjújah), the South Rewah and Sátpura basins: the most southerly place from which it is known is the Raigarh coal-field; but it is not yet known from any of the coal-fields to the north or south of the above area of distribution: thus it is not known from the Sikkim Damúdas, the Rájmahál hills; nor from the Talchir coal-field, the Nágpúr area, or the Godávári deposits.

Genus: TRIZYGIA, *Royle*, 1834.

1880. Feistmantel, *supra*, Vol. III, p. 69.

TRIZYGIA SPECIOSA, *Royle*.

1834. Royle, Botany, &c., Himalayan Mts., p. 431, Pl. II, fig. 8. a

1880. Feistmantel, *supra*, Vol. III, p. 69, and Plates.

Of this interesting species, which I have already fully described and illustrated (*l. c.*), a few specimens were quite recently also collected in the South Rewah basin. I have not figured any of them, the specimens being single leaf whorls, exhibiting the same characters as those from the Raniganj group, in the Raniganj coal-field. It follows somewhat the same geographical distribution as the *Schizoneura*, though occurring almost equally frequently on two different horizons. Thus we know *Trizygia* from the Raniganj coal-field (Raniganj group), Bokáro coal-field (Barákar group), Auranga coal-field (Barákar group), South Rewah basin (Raniganj group), Sátpura basin (Bijori horizon, Raniganj group). Outside of this area of distribution, *Trizygia* is also known from the Talchir coal-field (Barákar group), and it was quoted from the Sikkim Damúdas by Dr. Hooker.

*Occurrence in the South Rewah basin.*—*Raniganj group.*—Murna river, near Sohágpur, on the road to Páli (collected by Sub-Assistant Hira Lal, 1882).

Genus: VERTEBRARIA, *Royle*, 1834.

1880. Feistmantel, *supra*, Vol. III, p. 71 *et seq.*

VERTEBRARIA INDICA, *Royle*, Pl. XI, figs. 1—4.

1834. Royle, *l. c.*, p. 29, Pl. II, figs. 1, 2, 3, 5, 6, 7.

1880. Feistmantel, *supra*, Vol. III, p. 72, and Plates.

It was only natural to expect that *Vertebraria*, which is so very common in the other coal-fields, should be met with also in the South Rewah basin; and the expectation was fully realised. *Vertebraria* is a very common fossil here, not only widely spread over the coal-field, but also occurring at different horizons.

All the specimens which came under observation show the very same characters as those from the other areas.

I have figured on Pl. XI a few specimens which appeared to me some of the most characteristic forms; they do not furnish, however, any further information with regard to the systematical relations of this curious fossil beyond the fact I have already stated, that they appear to be rhizomes and roots of some other plant. Fig. 1, Pl. XI, is a branched specimen, the branchlets, I think, representing rootlets; this is a form resembling those known from the Nágpúr and Godávári area; the others resemble more those from the Raniganj coal-field.

*Occurrence in the South Rewah basin: Middle Gondwánas.*—(Transitional.) Daigaon on the Johilla river, north-west of Páli, Pl. XI, fig. 1; the specimens occur in fine-grained, reddish, mottled purplish sandstone (Hughes, 1880, 1881), and also in a greenish-grey shale (Hughes, 1882). The peculiarity of this locality from a stratigraphical point of view has been already discussed on page 7.

*Lower Gondwánas: Raniganj group.*—Bajbai, Gopat river, Pl. XI, figs. 2-4 (Hughes, 1880); Mahan river near Tansar (Hughes, 1880); Son river, west of Gurárú (Hughes, 1882, and Mr. Hacket, 1872); Chota Chauri on the Son (Hughes, 1882); Kurabar, east of Páli (Hughes, 1882); Sohágpur (Hughes, 1881, and J. G. Medlicott, 1861, *see* Feistmantel, Vol. III, Pl. XIVa, *bis* fig. 3); Banrakachar, (1882); Harri (1882); South Rewah (Gopat coal-field, J. G. Medlicott, 1861).

*Barákar group.*—Hardi, south-east-south of Sohágpur (Hughes, 1880); Dhobgata near Khodargaon (Hughes, 1882.)

*Talchir group.*—Behia Bargaon, north-east of Anukpur (Hira Lal, 1882.)

Besides the above-named equisetaceous species there also occur, as in other coal-fields, leafless stems, which it is of course very difficult to class correctly.

We only can judge of their nature from their association with one or the other equisetaceous species; on examination it is generally *Schizoneura* to which they most probably belong. I have figured only one of these stems, Pl. XI, fig. 5, as it shows a branch coming out from one of the joints; it does not show, however, any marks of leaves or of leaf sheaths in the articulation, nor can anything else be deduced from it.

It is from Bajbai, whence *Schizoneura* has also been quoted.

## FILICES.

### Order: GLEICHENIACEÆ.

#### Genus: GLEICHENIA, Sm.

Several fragments of a fern have to be placed in this genus, their pinnæ and pinnulæ bearing distinctly the character of those in the living forms, specially as regards their arrangement of the former on the rachis and as regards the character of the pinnulæ. We cannot say from our specimens whether the frond was dichoto-

mously branched or not, but as this is almost generally the case there seems to be little doubt that it was so also in our fossil. The fossil representatives are not very many; about four species are known from the cretaceous in Greenland, a number which would perhaps admit of reduction. Three species are quoted from the Cretaceous of Aix-la-Chapelle, and one species was described by Zigno from the Italian Lias (Verona). From India we know one species from the Rájmahál group in the Rájmahál hills (*Gleichenia bindrabunensis*, Schimp.); and one species from the Umia group in Kach (*Pecopteris tenera*, Fstm.) seems also to belong to this genus, though from the fragmentary condition in which it is known this cannot be decided with certainty.

GLEICHENIA REWAHENSIS, n. sp., Pl. I, figs. 15-19; Pl. XX, figs. 7-9.

*Fronde dichotoma* (?), *rachibus ramorum latiusculis, ramis bipinnatis; pinnis angustis, lineari-elongatis; pinnulis parvulis subcoriaceis, rotundato-obovatis, subtus (ut videtur) concavis, etiamque in superficie basin versus pinnulæ; duobus pinnulis ramorum rhachim versus, ceterorum majoribus, nervatione indistincta.*

I have in the above diagnosis represented the frond as dichotomous. This is perhaps justified on the grounds mentioned before, so that the specimens under description are the branches of the dichotomous frond; they exhibit a rather broad rhachis, while the pinnæ fixed to them are long and narrow; the pinnulæ are of somewhat a leathery consistence, obovately-rounded; they are concave below exhibiting a convex surface, and are also slightly depressed on the upper surface towards the point of insertion. The living *Gleichenia* also has the pinnulæ concave below. Another character in our fossil is that the two basal pinnulæ close to the rhaches of the branches are larger than the others, which is also the case in several of the living forms. This species from the South Rewah basin differs distinctly from *Gleichenia bindrabunensis*, by the much narrower pinnæ and at the same time much thicker rhachids of the branches, by the more leathery consistence and greater concavity of the pinnulæ, but chiefly by the much larger size of the two basal pinnulæ, a character which is wanting in the Rájmahál species.

Amongst the living forms our fossil resembles somewhat *Gleichenia semivestita*, Labill.<sup>1</sup> the rhachids of the branches are also thickish, and the two basal pinnulæ, close to the rhachids, exceed the others in size.

*Occurrence in South Rewah: Upper Gondwānas: Jabalpur group.*—Bansa on the Machrar river, south-west of Chandia (Hughes, 1880, Pl. I, figs. 15-19); from the same locality and from Umrar nadi, above Baragaon (Hacket, 1872, Pl. XX, figs. 7-9). The specimens collected by Mr. Hughes are in light reddish-grey earthy shale; those by Mr. Hacket in dark, earthy carbonaceous shale.

<sup>1</sup> Hooker, Spec. fil. I, p. 3.

## . Order: MARATTIACEÆ.

Genus: DANÆOPSIS, *Heer*.

This genus used formerly to be classed with the *Teniopterideæ*; but in his latest work on systematical palæobotany<sup>1</sup> Prof. Schimper has classed it with the *Marattiaceæ* on account of the mode of its fructification.

The best known and almost only European species is *Dan. marantæa*, *Heer*, of which the fructification is known.

From India I have already described one species, which although not exhibiting the fructification, yet bears all the other characters of *Danæopsis*, so that I could not class it with any other genus.

The same is the case with the specimens I am going to describe. I have once before quoted them under this name, but they are figured now for the first time.

*DANÆOPSIS HUGHESI*, *Fstm.* Pls. IV—VII, VIII, figs. 1, 5; IX, 4; X, XVII, 1; XVIII, 2; XIX, 1, 2.

1880. Feistmantel: *Rec. Geol. Surv., India*, Vol. VIII, Pt. 3, p. 187.

*Fronde valida, bifurcata; rhachi primaria, rhachibusque ramorum crassis, apicem versus sensim attenuantibus; pinnulis subrigidis, suberectis, inferiore in parte liberis, attingentibus, superiore in parte basi decurrentibus, confluentibus, rhachim alatam redentibus; pinnula apicali mediocri; costa pinnularum crassa, apicem versus attenuante apicē subevanescente; nervis secundariis oblique ex rhachide egredientibus subcurvatim ad marginem currentibus, hinc illinc simplicibus, plerumque e basi dichotomis.*

I have given many figures of this very interesting fern; all the specimens from which they are taken were collected by Mr. Hughes in the years 1880 and 1882. Several of the former were, after closer examination, found to fit together, and a pretty complete figure was constructed from them which will be found on Pl. X; this shows very well the general habitus of the plant, while other details can be derived from some of the other figures. All the specimens are sterile fronds, but there can be little, if any, doubt that they belong to the above genus.

From the specimens it appears that the frond was very large, and I think we can say dichotomous, for in all the specimens which represent the lower portions of the frond we find the primary rhachis dichotomously divided (*see* Pls. V, 1; VI, 1, 2; XVII, 1; XVIII, 2; and XIX, 2); or there are portions of the frond preserved in such a manner that we are forced to consider them as belonging to a dichotomous frond (*see* Pl. V, fig. 2; Pl. VIII, fig. 1). The primary rhachis is thick, and so are the rhachids of the branches, diminishing only slowly towards the top. The pinnulæ require special notice, exhibiting various characters according to their position on the frond.

<sup>1</sup> *Handbuch der Palæontologie*, Schimper and Zittel, II Bd., 1 Lief, 1879, p. 88.

From several specimens it is clearly seen that there were pinnulæ also on the primary rhachis below the place of division; these were oblongly-ovate, free and with rounded basal angles, traversed by a midrib thinner than in the pinnulæ of the upper portion, and having secondary veins of the same character as in the other pinnulæ. Sometimes the pinnulæ are somewhat shorter, more orbicular, and the veins radiating.

The same characters as the above are also exhibited by the pinnulæ after the division, at the beginning of the branches, at the outer side. At the inner side, however, at the beginning of the fork, the pinnulæ are at first orbicular, then somewhat squarely rounded and obovate with radiary veins, assuming afterwards more and more the shape of the pinnulæ of the middle portion.

In about the middle portion of the branches the pinnulæ become elongate, are pretty broad with an acuminate rounded apex, at the base somewhat decurrent, but not confluent and only touching; the midrib is rather strong; it passes out from the branch rhachis, so that it is closer to the upper margin of the pinnulæ than to the lower; turns off afterwards somewhat from the upper margin in its course towards the apex, but still so that it divides the leaflets into two unequal portions, the upper one being narrower and the lower broader.

In its course towards the apex the midrib diminishes only slowly in thickness, but it apparently does not continue right into the apex, but dissolves into the secondary veins. These latter are numerous, pass out obliquely, at angles of  $40^{\circ}$ — $45^{\circ}$  from the midrib and run slightly arched to the margin. They are mostly bifurcate, and this already from the base.

The pinnulæ of the upper portion bear the same characters as those in the middle, but are broadly decurrent along the rhachis, rendering thus the lower portion of the pinnulæ considerably larger than the upper; and they are distinctly confluent, producing thus a winged rhachis; but that these wings belong to the pinnulæ is clearly shown by the venation being the same as in the pinnulæ themselves.

This winged rhachis is well exhibited in the specimens figured on Pl. V, fig. 2, and specially Pl. XIX, fig. 1, where the wings are very nearly half an inch broad. The top of the branches finishes off in a pinnula of essentially the same characters as in the others, but smaller in size, as is exhibited in two of the specimens (Pl. V, fig. 2; XIX, 1).

The plant figured on Pl. X is not one of the largest size; this appears to be a middle-sized specimen only. There is figured on Pl. IV another specimen, which appears to represent the upper portion of one of the branches, and which, judging from its size in comparison with that one figured on Pl. X, must have belonged to a plant about twice as large. The same is to be said of the two portions of pinnulæ on Pl. IX, fig. 4.

The rhachis of the branches exhibits also in several cases longitudinal lines, and between these densely arranged transverse wrinkles (Pl. IV; VII, fig 1; XVII, 1; XVIII, 2), which character also passes on to the rhachids of the pinnulæ.

The above description applies to plants of regular development, but there is one specimen which requires special mention, as exhibiting some deviation from the generality of the cases; it is figured on Pl. XVIII, fig. 2. Here we see a portion of the primary rhachis before the division; it exhibits the longitudinal lines and transverse wrinkles mentioned before; the leaflets attached to it are, as described before; after the division the rhachids of the branches show the same character as the primary rhachis; the leaflets outside are, however, considerably decurrent and connected together, as is exhibited in the other cases in the top portion of the branches. Inside the fork we also see a deviation from the rule; here we do not find small orbicular or oval pinnulæ increasing in size upwards, but a very long wing-like appendage, which seems to be the decurrent side of the apical pinnula, with which the branches have finished off; our specimen does not exhibit the top, but it appears to me that the branches passed at once into the apical pinnula without forming any lateral pinnulæ inside the fork. This broad wing inside exhibits the same venation as the pinnulæ. It appears to me that this specimen represents an undeveloped, dwarfed plant.

Amongst all the numerous specimens none showed any sign of fructification, so that nothing can be said on this point.

We have now to compare our new species with the two others described previously. The most complete specimen of *Danaeopsis marantacea*, Heer, is figured in Prof. Schimper's Atlas to his "Palæontologie végétale," Pl. XXXVII; to judge from this, *Dan. marantacea* was a much larger and stronger plant, as can be judged from the apparent thickness of the leaflets; these were much longer in comparison with their breadth, and the apical pinnula was of very great length, such as has not been observed in any of our specimens. The chief difference will be found in the venation of the pinnulæ. The midrib also here traverses the pinnulæ closer to the upper than the lower margin, but runs distinctly up to the apex of the pinnulæ, and the secondary veins pass out from it at a much higher angle.

This fern is always described as a single frond, but it is hitherto known in incomplete specimens only, which cannot give a sufficient idea of the whole frond; and it may well happen that more complete specimens will also show a dichotomous frond; in the meantime we have to regard the dichotomy in our species as a further distinctive character from *Dan. marantacea*, Heer.

Of *Dan. rajmahalensis*, Estm., only two rather fragmentary specimens are known; this species again appears smaller than the new one and of a less leathery consistence; the midrib of the pinnulæ is thinner in the Rájmahál form, and the secondary veins pass out at a somewhat more acute angle, and their direction towards the margin is more straight.

Thus the South Rewah species may fairly be considered as a new one.

*Occurrence in South Rewah: Middle Gondwana.*—Parsora, near Beli, north-north-east of Páli (Hughes, 1880-82).



## Order: CYATHEACEÆ.

SPHENOPTERIS POLYMORPHA, *Fstm.*

1880. Feistmantel: Gondwána Flora, Vol. III, Pl. 2, p. 76, and Plates.

A few fragments of this plant were identified only recently from two localities I have not prepared any figures of them, and refer to my previous volumes for illustrations and all further description. The identification of this species is only in so far of interest as it helps in fixing the horizon of the beds in which it occurs. It is known from the Barákar group, but is much more numerous in the Raniganj group.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Hill between Karkote and Malhadu; Kurabar, east of Páli (Hughes, 1882); Son river, near its junction with the Murna (Hughes, 1881).

GENUS: DICKSONIA, *L'Hérit.*

Three species of this genus have previously been described from the Gondwánas; one of them has to be recorded also from the South Rewah basin.

DICKSONIA HUGHESI, *Fstm.*, Pl. XII, figs. 3, 3a, 3b.

1880. Feistmantel: Gondwána Flora, Vol. III, Pl. 2, p. 52; Pl. XXIII, A, figs. 1, 2.

The present specimen, though somewhat larger than those figured in Vol. III, is so very much like them in all the characters that there can be little doubt of its belonging to the same species; and there is also nothing to be added as regards the general description. But we have in our present specimen an additional character, which requires special notice. It is in a state of fructification, which, however, is not very distinct; but the enlarged pinnulæ, fig. 3b, give, I think, a fair idea of it; the sori are placed on the outer margin of the leaf-lobes at end of the veins. This specimen from South Rewah thus completes our knowledge of this species, which was founded upon specimens from the Jharia coal-field.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Son river, near its junction with the Murna (Hughes, 1881).

## Order: POLYPODIACEÆ.

Type: ASPLENIUM, *Lin.*ALETHOPTERIS, *Göpp*, ex. p.

ASPLENIUM WHITBYENSE, *Heer* (including *Alethopt. indicæ*, Oldh. and Morr.), Pl. I, figs. 1-11; Pl. VIII, figs. 2, 3.

1876-79. Gondwána Flora, Vols. I and II.

1880. Gondwána Flora, Vol. III, Pt. 2, p. 52.

This species has been noticed by me already several times in the pages of the "Palæontologia Indica," and described from various horizons. I give at present again several figures, many of which at the same time bear close resemblance to *Al. indica*, O. M., which latter, I think, has also to be classed with *Aspl. whitbyense*, Heer. The difference between the two consists indeed in the size only, which, however, may very well find its explanation in the circumstance that both may represent only different parts of the same frond.

An examination of the figures on Pl. I will show this fact sufficiently well. Figures 2, 6, 7, and 10 are of the *Alethopteris indica* type, while the rest are the typical *Al. whitbyensis*, Heer.

*Occurrence in South Rewah—*

(a) *Upper Gondwānas, Jabalpur group.*—Bansa on the Machrar river (Hughes, 1882); small stream south of Chandia (Hacket, 1872).

(b) *Middle Gondwānas.*—Parsora near Beli (Hughes, 1882); this latter figured on Pl. VIII, figs. 2, 3.

Figure 10 on Pl. I is not from South Rewah, but from the Jabalpur group, near Jabalpur; it is a supplemental figure to my Jabalpur Flora, the specimen not being then available for figuring.

ASPLENIUM, comp. WHITBYENSE, Heer.

Already in my flora of the Damúda and Panchet divisions (Lower Gondwānas) I had an opportunity to mention fragments of a fern which I could not distinguish from the above species, and I quoted it as *Al. comp. whitbyensis*, Heer.

Similar fragments are also known from the South Rewah basin, from two localities, which I have thus to quote with the same name. I have not given any figures, the specimens being fragmentary only, representing a few pinnulæ; but they are of the same type as those figured by me from the Raniganj coal-field (Vol. III, Pl. XIXA, fig. 2).

*Occurrence in the South Rewah basin, Raniganj group.*—Mahan river between Minarra and Gaja (Hughes, 1880), and Mahan river near Minarra (Hughes, 1880). These two localities are so close to each other that they more conveniently might be considered as one locality only.

Genus: ALETHOPTERIS.

There is one more *Alethopteris*, or at least *Alethopteris*-like fossil to be recorded, about the systematical position of which I am at present not quite so certain as I was when I at first described it.

*ALETHOPTERIS MEDLICOTTIANA*, Oldh., Pl. I, fig. 14 (12, 13).

1877. Feistmantel, Gondwana Flora, Vol. II, p. 87.

This species was first described from the Jabalpur group of the Sâtpura basin. I then included it in the group of *Alethopteris whitbyensis* from its analogy with *Pecopteris ligata*, Phil., which also belongs to that group, but more recent comparisons have suggested another view, viz., that it may have affinities with *Mertensia*, one of the *Gleicheniaceæ*.

But apart from this systematical uncertainty, the occurrence of this species amongst the South Rewah fossils is of considerable interest in helping to establish the horizon of the beds in which it occurred.

*Occurrence in South Rewah : Upper Gondwanas : Jabalpur group.*—At Bansa on the Machrar river, about 6 miles south-west of Chandia (Hughes, 1880).

## Order: LOMATOPTERIDEÆ.

## GENUS: THINNFELDIA, Braun.

THINNFELDIA, comp. ODONTOPTEROIDES, Morr., sp. Pl. VIII, figs. 4, 6, 7 ;  
Pl. XX, fig. 5.

1845. Morris, in Strzelecki, New South Wales, &amp;c., Pl. XX, fig. 5.

1879. Feistmantel: Flora des östlichen Australiens, Palæontographica, Suppl. III, Lief III, pp. 105, 165.

I place this species, which was at first described from Tasmania and later from New South Wales, with *Thinnfeldia*, although other authors may take a different view of it. This, however, is a small matter, so long as the plant is sufficiently well characterised for identification; in the work quoted above on the Australian Flora, I have given a complete review of the various stages of classification this fossil has passed through, and have also stated my reasons why it may best be classed with *Thinnfeldia*. It has also been identified amongst the Gondwana fossils.

I have already in my Damúda Panchet flora given a few figures of this fern from beds of supposed Panchet age, in the Ramkola coal-field. At present I give some more figures of specimens from the South Rewah coal-field. These specimens, though exhibiting the same shape of the pinnulæ, do not show any veins, but there can be little doubt about the identification; they are very much like the specimens figured in Strzelecki's work (Plate VI, figs. 2, 3, 4); these, however, as well as those from the Ramkola coal-field, exhibit simple pinnæ only, while the present figures exhibit a dichotomy of the frond which I have before noticed in many of the Australian specimens examined by me, and which also occurs as a rule in *Thinnfeldia*. I have already, when describing the Ramkola specimens, referred to the close relation of *Pecopteris odontopteroides*, Morr., and *Thinnfeldia crassinervis*, Geinitz, to which reference ought to be made here again, especially if we consider the great apparent variability of this form in size. The pinnulæ are obtusely

obovate, opposite, sessile, and contiguous; they continue with the same characters below the point of dichotomy on the primary rhachis, but becoming smaller; above the point of dichotomy, on the inner side of the pinnæ, they begin as mere lobes, developing further on into regular pinnulæ.

*Occurrence in South Rewah.*—Horizon not certain (Middle Gondwánas): Parsora near Beli, north-north-east of Páli (*Collectio* Hughes, 1880-82).

From the occurrence of this species in the Panchets of the Ramkola coal-field, I at first inclined to the view that the beds at Parsora might also belong to that horizon, especially as from the occurrence of *Nöggerathiopsis* I thought that they should be classed in the Lower Gondwána division. The stratigraphical relations seem, however, to be somewhat opposed to this view, suggesting a higher horizon; so I have included this locality in that portion of the Gondwána system which may represent transitional beds and may well be distinguished as Middle Gondwánas.

#### Order: TÆNIOPTERIDÆ.

##### SUB-GENUS: MACROTÆNIOPTERIS, *Schimp.*

##### MACROTÆNIOPTERIS FEDDENI, *Fstm.* Pl. XXI, fig. 5.

1881. Feistmantel: Gondwána Flora, Vol. III, 2, p. 88, and figures.

When describing this species from the Nágpúr area I mentioned its occurrence in South Rewah, but could not then give a figure of the only specimen from this ground; it is not so well preserved as those from Nágpúr, but the identity is well established, especially by the characters of the veins; they are very nearly horizontal (the fossil representing most probably the lower portion of the leaf), very closely set, rather thin, and most of them dichotomous almost from the base.

There is nothing further to be remarked about this specimen. A much more complete one will be figured and described in the second part of this volume, containing illustrations and descriptions of the fossils collected by myself in 1881 in the coal-fields of Hazáribágh and Chutia Nágpúr.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—On the Son river, west of Gúrárú (*Collectio* Hacket, 1872). The fact of the horizon at Gúrárú being of the Raniganj group is now established beyond any doubt by Mr. Hughes' fossils, and it is thus interesting to find *Macrotæniopteris feddeni* amongst the Raniganj fossils.

##### ANGIOPTERIDIUM, comp. MCCLELLANDI, *O. & M.*

1881. Feistmantel: *supra*, Vol. III, pp. 92-93, and figures.

Fragments of another *tæniopteroid* plant were also met with. I have not figured them, but I mention them as they come from the lower portion of the Gondwánas

and appear to represent an Upper Gondwána form, though from the fragmentary condition of the specimens the assertion cannot be made with certainty. In my above work I have had occasion to describe and figure some more complete specimens from the Nágpúr area, referring them to the same species; with these our fragments from South Rewah are, I think, identical; the fragments are of a narrow leaf, with a thin midrib, the secondary veins rather closely set, running very nearly horizontally to the margin, and to a great extent dichotomous.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Mahan river, between Minara (Minhara) and Gajar (Ganjar). (*Collectio Hughes*, 1880) (Gopat area).

### Order: DICTYOTÆNIOPTERIDÆ.

#### (GLOSSOPTERIDES.)

GENUS: GLOSSOPTERIS, *Bgt.*, 1828.

1881. Feistmantel: *supra*, Vol. III, Pl. 2, p. 94 *et seq.*

In preceding volumes of the Gondwána Flora I have discussed at length the characters of this genus, its distribution in India and other countries; and I have proposed a grouping of the numerous species in various sections to facilitate their classification. Amongst the South Rewah fossils this genus is again numerous, and I shall adopt the same grouping as heretofore.

#### SECTION A.—FORMS WITH NARROW NETS.

GLOSSOPTERIS COMMUNIS, *Fstm.* Pl. XII, figs. 1, 1a; Pl. XXI, figs. 13, 14.

1881. Feistmantel: *supra*, Vol. III, p. 98, and Plates.

For the characters I may refer to my previously published descriptions, only making here a few remarks with regard to the figures. Fig. 1 on Pl. XII represents a specimen of the ordinary appearance of this species; the nets are narrow and prolonged. Figs. 13 and 14 on Pl. XXI are of more interest: they represent specimens in fructification. Several specimens exhibiting a fructification, from the Nágpúr area, have already been figured; the fructification in the present specimens is exactly the same, *viz.*, round sori, arranged in longitudinal rows.

This species is as numerous in this field as in the other districts.

*Occurrence in South Rewah—*

(a) *Transitional beds (Middle Gondwánas).*—Daigaon, west of Páli, in ochre-brown sandy shales (*Collectio Hughes*, 1882).

(b) *Lower Gondwánas, Raniganj group.*—Hill between Korkoti and Malhadu (1882); Kurabar (1882); near deserted site of Ghogri (1882); Kacho-

dhar, near Sohágpur (1880 and 1882), the fructifying specimens figured on Pl. XXI, figs. 13, 14); Murna river near Sohágpur (*Collectio* Hira Lal, 1882); Simaria (1881); Sohágpur (*Collectio* J. G. Medlicott 1861); Amliha near Maiki (1882); Chiraipani (1882); Diapipar (1882); Harri (1882); Kedoundi (1882); Kichri (1882); Kunuk (1882); Chota Chauri on the Son (1882); Gúrará on the Son (*Collectio* Hacket, 1872, and Hughes, 1880 and 1882—amongst the latter specimens there were large forms of this species resembling those from the Raniganj group of the Jharia coal-field); Son river, near junction with Murna river (1881) (all these localities are in the Sohágpur district); Bajbai, near Gopat river (1880—the specimen figured on Pl. XII, fig. 1 is from this locality); Mahan river, at two localities (1880); South Rewah (*Collectio* J. G. Medlicott, 1861). These latter localities are in the Gopat area.

- (c) *Lower Gondwánas, Barákar group*.—Amliha, between Dongra and Tumbhar (1882); Dumarkachar, east of Anukpur (east of Sohágpur, Hughes, 1881); Kadri, Singwara Ilaka (1882); junction of Páli and Johilla rivers near Páli (1880).
- (d) *Karharbári beds*.—Hardi and Khaira in a southern direction of Sohágpur (1880-81) Umeria-Kaleshar, north-west of Páli (1881-82).

#### GLOSSOPTERIS INDICA, *Schimp.*

1881. Feistmantel: *supra*, Vol. III, p. 101, and figures.

No specimens of this species are now figured, its characters being the same as those already described. Its distribution is more limited than that of *Glossopteris communis*.

#### *Occurrence in South Rewah—*

- (a) *Uncertain horizon*. (Middle Gondwánas): Daigaon, near Páli (1882).
- (b) *Lower Gondwánas: Raniganj group*.—Mahan river, near Chiraipani (1881); Minarra (Hughes, 1880), Gopat area; Gúrará, on the Son river (1880-82); Chota Chauri on the Son (1882).
- (c) *Lower Gondwánas: Barákar group*.—Dhobgata nadi, south of Khodargaon, 1882).
- (d) *Karharbári beds*.—Pinaora, South Rewah, Singwara district.

#### GLOSSOPTERIS STRICTA, *Bunb.*, Pl. XXI, fig. 11.

1881. Feistmantel: *ibid.*, p. 100, and figures.

At the same locality, from which I quoted before the fructifying specimens of *Glossopteris communis*, there was found another species of *Glossopteris*, which also occurred in company with fructifying specimens of *Gl. communis* in the Kámthi

beds of Nágpur. The present specimen represents the basal portion of a leaf with a strong midrib, which is longitudinally striated; from this pass out the secondary veins in their characteristic form and direction, *i.e.*, passing out at a certain angle and being somewhat polygonal close to the midrib, whence they proceed straight to the margin, the nets becoming narrower.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Kachodhar, west of Sohágpur (1882). Only one specimen was found at this single locality (Pl. XXI, fig. 11).

#### SECTION B.=INTERMEDIATE FORMS.

I include in this section a new form, which, from the characters of the nets appears to be best placed here.

#### GLOSSOPTERIS CORDATA, *sp. nov.*, Pl. XX, fig. 1.

*Foliis oblonge ovatis, rhachide distincta; apice ignotq. parte basali a ceteris adhuc notis speciebus aberrante, subauriculato-cordata; nervis secundariis summa in parte sub angulo acuto egredientibus, retia longiuscula angustaque formantibus; inferiore in parte into lobum basalem radiantibus, retia polygonalia exhibentibus.*

This is quite a peculiar species, distinct from all others of this genus by the character of the basal portion; this is here rather broad, expanded into two sub-auricled lobes, forming thus a cordiform base; corresponding with this we also find the distribution of the veins differing from that in the other species of *Glossopteris*. The veins in the upper portion of the leaf pass out at an acute angle, and form rather narrow nets, slightly larger, close to the midrib. Towards the lower portion, however, the direction of the veins changes; they pass out at less acute angles until in the basal lobes they are radiating, *i.e.*, changing from a slightly upwards direction to a horizontal and downwards direction, the nets at the same time increasing in breadth until in the basal lobes they are pretty conspicuous, short and polygonal. Only one specimen has so far been found. In the form of the leaf, in its basal portion it shows an analogy to *Gangamopteris subauriculata*, the presence of a distinct midrib in one case and the absence of it in the other forming the chief distinction.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Hill between Karkoti and Malhadu (1882, the figured specimen).

#### GLOSSOPTERIS BROWNIANA, *Bgt.* Pl. XII, fig. 4; Pl. XX, fig. 3.

1881. Feistmantel: *supra*, Vol. III, p. 102, and figures.

The net venation of this species is polygonal throughout, only towards the margin becoming somewhat narrower as well as in the apical portion. It appears to be on

the whole a smaller species than either *Gl. communis* or *Gl. indica*, and from the fig. 3 on Pl. XX, which is a very nearly complete specimen, it would appear that the apical portion was broader and more obtuse than in either of the two above species.

*Occurrence in South Rewah—*

(a) *Lower Gondwánas: Raniganj group.*—Bajbai, Gopat area (Hughes, 1880. Pl. XII, fig. 4); Son river, near Gúrúrú (1882, Pl. XX, fig. 3); Son river, opposite Sarsi (1880); Sohágpur (*Collectio* J. G. Medlicott, 1861; l. c. Pl. XLA, fig. 5).

(b) *Lower Gondwánas: Barákar group.*—Dhobgata, near Khodargaon (1882). .

SECTION C.—BROAD-NETTED FORMS.

GLOSSOPTERIS DAMUDICA, *Fstm.*

1881. Feistmantel: *supra*, Vol. III, Pl. II, p. 105; Pl. XLa, fig. 6, a South Rewah specimen.

This species, as occurring in South Rewah, has already been noticed and described in Vol. III; since that time it has been identified from additional localities. I have, however, not seen any necessity of figuring other specimens. .

*Occurrence in South Rewah—*

(a) *Lower Gondwánas: Raniganj group.*—Kurábar, east of Páli (Hughes, 1882); Sohágpur (J. G. Medlicott, 1861—the specimen figured in my above work); Chiraipani (1882).

(b) *Lower Gondwánas: Barákar group.*—Dhobgata nadi, south of Khodargaon (1882).

GLOSSOPTERIS RETIFERA, *Fstm.*

1881. Feistmantel, *ibid.*, p. 103, and figures.

This nice species was met with at one locality only; the specimens do not call for any special notice.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Mahan river, near Minarra (Hughes, 1880).

SECTION D.—NARROW-LEAVED FORMS.

GLOSSOPTERIS ANGUSTIFOLIA, *Bgt.*

1881. Feistmantel: *supra*, Vol. III, p. 105, and figures

There is nothing new to be added regarding this species, except with respect to its distribution. I have already quoted it from three localities, the number of which has since increased; and it has also been found on various horizons.



## FOSSIL FLORA OF THE GONDWÁNA SYSTEM IN INDIA.

### *Occurrence in South Rewah—*

- (a) *Lower Gondwánas: Raniganj group.*—Bajbai, on the Gopat river (Hughes, 1880); Mahan river, at two localities (1880); Son river, near Gúrúrú (1880); Son river, near junction with Murna river (1881); Amliba, near Maiki (1882).
- (b) *Lower Gondwánas: Barákar group.*—Chatan, north-west of Umaria (1882).
- (c) *Lower Gondwánas: Karharbári beds.*—Pinaora, Singwára district (1882).

GLOSSOPTERIS FORMOSA, *Fstm.*, and *var. major*, Pl. XXI, fig. 12.

1881. Feistmantel: *supra*, Vol. III, p. 106, and figures.

I have not figured any of the South Rewah specimens of *Gl. formosa*, as they are less complete than those originally described from the Raniganj coal-field, to which I now refer (*l. c.*). But there is another fossil which I think to be only a larger variety of this species; one leaf is figured on Pl. XXI. It has no doubt to be classed with the narrow-leaved forms; for, although it is somewhat broader than the majority of the forms classed under this section, yet it has an appearance as if it were much narrower in proportion to the length, than is the case in the forms of the other sections; in fact, the leaf appears broadly lanceolate instead of oblongly oval. The midrib is distinct; the secondary veins pass out under a rather acute angle and form conspicuous, oblongly polygonal nets.<sup>1</sup> If we compare our present figure with that given in Vol. III, Pl. XXXIXa, fig. 4, we shall find that they resemble each other very closely in all characters except the size, so that I think it right to distinguish this form from South Rewah as only a variety of the above species.

*Occurrence in South Rewah: Lower Gondwánas: Raniganj group.*—Chanduidol, near Bajbai, Gopat river (1880); Chota Chauri, on the Son (1882); Murna river, near Sohágpur (1882). These are the localities for *Gloss. formosa*, *Fstm.*

The variety was found at Gúrúrú, on the Son river (1882)—the specimen figured on Pl. XXI, fig. 12).

GLOSSOPTERIS TENIOIDES, *n. sp.*, Pl. XXI, figs. 4, 9.

*Foliis angustis, elongato-lanceolatis, costa crassa, lineata, nervis secundariis sub angulo acuto egredientibus, retia distincta, sed duo-tria-seriatim solum formantibus.*

This species is an addition to the forms of this section. The leaf is narrow, oblongly lanceolate, ribbon-like; whence the specific name. The midrib is very broad,

<sup>1</sup> I am sorry to find that the lithographer represented the nets rather more rhombical; but accidents like this are, as a rule, beyond control, especially in this country.

dicucyng one-fourth—at some place more than that—of the entire breadth of the leaf; it is longitudinally lined; the secondary veins pass out at about an angle of  $50^{\circ}$  to  $55^{\circ}$  and form rather conspicuous nets, so that the actual leaf surface on both sides of the midrib being only narrow, there are no more than two or three meshes produced by each secondary vein in the space between the midrib and the margin of the leaf. About the apical and basal portion nothing can be said from the specimens available for examination.

A species which resembles the form under discussion with regard to the form of the leaf and character of the midrib is *Glossopt. Wilkinsoni*, Fstm., from the Newcastle beds in New South Wales,<sup>1</sup> but the secondary veins in this species are more horizontal and form only one or one-and-a-half meshes between the midrib and the margin.

*Occurrence in South Rewah: Lower Gondwánas: Karharbári beds: Pinaora, Singwára district (Hughes, 1882).*

#### • Order: DICTYOPTERIDEÆ.

Amongst the South Rewah fossils only one genus represents this order, *viz.*, *Gangamopteris*. Its occurrence is so far of interest as two localities at least have to be classed with the Talchirs, thus increasing our knowledge of the distribution of the Talchir flora, but showing at the same time that the character of this Flora is the same at all the localities now known, and that it is everywhere only poor in forms.

#### GANGAMOPTERIS CYCLOPTEROIDES, Fstm., Pl. XVI, figs. 1-3, 4a.

1879. Feistmantel: Gondwána Flora, Vol. III, pt. 1, p. 12, and Plates.

This species was largely illustrated in my above work, when specimens, both from the Karharbári and Talchir beds, were figured; in fact this species was amongst the first collected from the Talchir shales in Bengal. The specimens figured at present agree exactly with the original typical form, and there is no doubt that this come out of beds belonging to the Talchir group. Fig. 1 (Pl. XVI) has all the characters of the original "*Cyclopteris*-like" leaf from the Talchir shales, which is figured in my Talchir Karharbári Flora,<sup>2</sup> Pl. VII; the other figures show also the same characters. Fig. 2 (Pl. XVI) resembles somewhat McCoy's *Gangamopteris obliqua* from Victoria, as altogether I think that these two species are analogous forms.

The specimens figured now bring out well the "*Cyclopteris*-like" character of the leaf, with radiating veins without a midrib, but forming oblong nets, broader in the middle portion and becoming very long and narrow towards the margin.

<sup>1</sup> Feistmantel, Flora des Oestl. Australiens; Palæontographica, Suppl. III, Lief. III, Heft. 3, Pl. XIII, fig. 1.

<sup>2</sup> Gondwána Flora, Vol. III, Pt. I, 1879.

I have not figured any specimens from the other localities, most of them not being well enough preserved.

*Occurrence in South Rewah—*

(a) *Lower Gondwānas: Barákar group*<sup>1</sup> (Karharbári beds ?); Dumarkachar, east of Anukpur (Hughes, 1881); Mangtar, south of Páli (1881); junction of the Páli and Johilla rivers near Páli (1880).

(b) *Lower Gondwānas: Talchir group*.—Anukpur, west of, in river (1881). The specimens figured on Pl. XVI, figs. 1, 2, 3, 4a; Bareri, north-west of Páli (1882); Ulsar, in Nagdhadhar nadi (Hira Lal, 1882).

Together with the above specimens was also found a variety of the species just quoted, viz., *Gangam. cyclopteroides* var. *attenuata*, Pl. XVI, fig. 4b. Besides from Anukpur (Talchir) I have identified it also from Umaria-Kaleshar, north-west of Páli, and also from Pinaora, which localities I believe have to be included under the heading of Karharbári beds; the specimen from this latter place is figured on Pl. XXI, fig. 7.

Still another variety has to be mentioned, viz., *Gangamopteris cyclopteroides* var. *subauriculata*; it is figured on Pl. XXI, fig. 1. The leaf is not quite complete, but from its shape, as well as from the direction of the veins, one can, I think, judge of the shape of the basal portion, and this appears very nearly equally broad as the leaf itself, and the basal angles appear rounded and slightly auricled. This species, though also known from the Talchir group, is especially well developed in the Karharbári beds of the Karharbári coal-field, and the specimen figured now from South Rewah is also from a locality, Pinaora, already mentioned with the preceding variety, which, I think, belongs to the Karharbári beds.

I have now to notice a few other species of *Gangamopteris*, especially with regard to the distribution of the respective species.

GANGAMOPTERIS, MAJOR, *Fstm.* Pl. XV, figs. 13, 14; Pl. XX, 2.

1879. Feistmantel: Gondwāna Flora, Vol. III, Pl. 1, p. 15, and figures.

This species, which, as I have already mentioned (*supra*, Vol. III), has a certain resemblance to *Gang. spathulata*, McCoy, from Victoria, has hitherto only been known from the Karharbári beds in the Karharbári coal-field. I have now identified it from the Talchir group also; the specimen figured on Pl. XX, fig. 2, is the specimen in question. A comparison of the same with those originally figured in my Talchir-Karharbári flora will show that there is little doubt about its being *Gang. major*; the leaf is spathulate, the veins radiating regularly and straightly from the base into the leaf, somewhat after the manner of *Nöggerathiopsis*, but forming a net venation consisting of long and narrow nets.

The two other specimens figured on Pl. XV (13, 14) show the same characters.

<sup>1</sup> I class here the following localities with the Barákar group, though I think they might as well represent the Karharbári beds, as it appears to me that Mr. Hughes inclines more to the view of their being of the Barákar group.

*Occurrence in South Rewah—*

- (a) *Lower Gondwánas : Karharbári beds.*—Between Hardi and Sárangpur, south-south-west of Khaira, south-east of Páli (Hughes, 1881, Pl. XV, figs. 13, 14).
- (b) *Lower Gondwánas : Talchir group :* Bareri, river east of, north-west of Páli (1882, Pl. XX, 2). There is certainly no doubt that this locality belongs to the Talchir group, and we have thus for *Gang. major*, Fstm., a lower range than was known before.

One more specimen of *Gangamopteris* has to be noticed ; it is figured on Pl. XXI, fig. 3 ; it is rather too incomplete to be identified with certainty ; it might be a portion of a leaf of *Gang. subauriculata* ; but, judging from the narrower shape of the leaf and from the somewhat differing distribution of the veins, I rather feel inclined to consider it as in closer relation with *Gangamopt. angustifolia*, McCoy, from New South Wales and Victoria, and I have therefore quoted it in the systematical list of fossils as *Gang. comp. angustifolia*, McCoy. This specimen is from Pinaora, in the Singwára district, from beds which I consider to be *Karharbári beds*.

## INCERTÆ SEDIS.

There are two other forms, the veins of which form nets, at least partly, and which may therefore be appended here. They have already been described and figured, and their names are mentioned here only for the sake of completeness :—

*Sagenopteris ? sp.*

1877. Feistmantel: Flora of the Jabalpur group, Gondwána Flora, Vol. II, pt. 2, p. 90 ; Pl. III, fig. 6.

*South Rewah : Jabalpur group.*—Chandia, small nadi south of (Coll. Hacket, 1872 ).

*Dictyopteridium, sp.*

1881. Feistmantel: Gondwána Flora, Vol. III, pt. 2, Pl. XLIIa, fig. 5.

*South Rewah : Lower Gondwánas : Raniganj group.*—Son river, west of Gúrúrú (Coll. Hacket, 1872 ).

## GYMNOSPERMÆ.

## CYCADEACEÆ.

## Order: ZAMIEÆ.

The representatives of *Cycadeaceæ* from the South Rewah basin are not very numerous, and they are all of the order *Zamieæ*. Only a few of them require a somewhat longer notice.

## GENUS: PODOZAMITES, Braun.

**PODOZAMITES LANCEOLATUS**, Lindl. and Hut., Pl. II, figs. 2-5.

1877. Feistmantel *supra*, Vol. II, pt. 2, p. 91 *et seq.*, and figures.

Leaves of this species are pretty numerous, and are of the same character as those previously described. I had then figured several specimens from South Rewah

to which I also refer now. The specimens procured since are also all detached leaves only, and we have not hitherto any of the leaves fixed to the rhachis.

*Occurrence in South Rewah : Jabalpur group.*—Bansa, near Chandia (Hughes, 1880—the specimens figured now), also south-east of Chandia, near Barwar (1881).

Small stream south of Chandia (Hacket, 1872—the specimens figured in Vol. II, Pl. III, figs. 7, 8, 11, 12); Sandabah river (Hughes, 1882).

PODOZAMITES SPATHULATUS, *Fstm.*

1877. *Supra*, Vol. II, pt. 2, Pl. IV, figs. 11, 12.

I have already described this species (*l. c.*); the specimens were from South Rewah. No other specimens have been met with since.

*Occurrence in South Rewah.*—Chandia, small nadi, south of (Coll. Hacket, 1872).

GENUS: PTILOPHYLLUM, *Morr.*

PTILOPHYLLUM CUTCHENSE, *Morr.*

This species has been already several times described and figured in the various papers on Upper Gondwana fossils, so there is no necessity of mentioning it any further here. I would only remark that it was met with but rarely, only one specimen having been found at one locality. I have not figured it, it being of the ordinary type of this species.

*Occurrence in South Rewah : Jabalpur group.*—Bansa, near Chandia, in black shale (Hughes, 1880).

Family: NÖGGERATHIOPSIDEÆ.

1879. Feistmantel; Talchir-Karharbári Flora; Gondwana Flora, Vol. III, Pt. I, p. 20 *et seq.*

1881. Supplem. to the above, *ib.*, p. 55, *et seq.*

1881. Damuda Panchet Flora, *ib.*, Pt. II, p. 118, *et seq.*

GENUS: NÖGGERATHIOPSIS, *Fstm.*

Literature same as above.

This genus, which has been before described and illustrated from various coal-fields, has also in South Rewah a very wide distribution and passes through several horizons. Besides the one well-known species hitherto described, there are amongst the South Rewah fossils certain leaves which I believe to be a new species of this genus.

*Nöggerathiopsis hislopi*,\* *Fetm.* (*Bunb.* sp.), Pl. IX, figs. 1-3; Pl. XIII, 2-4; Pl. XIV, 1-3, 6, 9; Pl. XV, 4b; Pl. XVII, 4; Pl. XVIII, 1; Pl. XX, 10; Pl. XXI, 6, 8, 10.

Literature same as above.

The characters of this species, as already described (*l. c.*), are again found in the present specimens; their shape is generally elongately spatulate; they vary a good deal in size, showing in connection with this character also a slight variation in shape, some being broader than others, and others again much longer. In the supplemental fasciculus to my Talchir-Karharbári Flora, I have figured on Plates XXIX and XXX some specimens of this species, which I thought to be of an unusually large size; some of those figured at present are, however, as large. The veins, where visible, are distinctly dichotomous, starting from stronger veins in the basal portion, becoming thinner and thinner as they proceed upwards and more numerous by dichotomy. Hardly any of the leaves (or, more properly said, leaflets) are complete; the basal portion is nowhere exhibited in its integrity, and altogether up to now, in spite of the great number of observed specimens, we do not know any specimen which would show the base intact, so as to enable us to form an idea of the proper mode of insertion of the leaflets. The apex is obtusely rounded; in others somewhat more acuminate.

I have already in the Damúda-Panchet Flora figured several specimens of *Nöggerathiopsis hislopi* from South Rewah, the horizon and locality of which, however, was not quite certain, although both were, as it appears, guessed correctly.

*Occurrence in South Rewah: Uncertain horizon* (transitional beds—Middle Gondwána).—Parsora, near Beli (Hughes, 1880, Pl. IX, figs. 1-3).

*Lower Gondwánas—*

(a) *Raniganj group*.—South Rewah (probably Gopat coal-field.—*Coll.* J. G. Medlicott; Pl. XLV4, figs. 1-5, in my Damúda-Panchet Flora, *l. c.*).

(b) *Barákar group*.—Mangtar, south of Páli (Hughes, 1881); Páli and Johilla river, junction of, near Páli (1880—Pl. XIII, figs. 2-4; Pl. XVII, 4; Pl. XVIII, 1); Kudri, south-west of Páli (1882).

(c) *Karharbári beds*.—Umeria, north-west of Páli (1881); Hardi, south-west of Khaira (1880); Dhamni, south-east of Khaira (1881—Pl. XIV, figs. 1-3, 6, 9; Pl. XV, 4b); Pinaora, Singwára district (1882—Pl. XXI, figs. 6, 8, 10).

(d) *Talchir group*: Bareri, north-west of Páli (1882; Pl. XX, fig. 10).

We have thus in South Rewah for *Nöggerathiopsis hislopi* a distribution from the Talchirs through the whole Lower Gondwána division and beyond it.

NÖGGERATHIOPSIS LACERATA, *n. sp.*, Pl. XV, figs. 1-3, 4a; Pl. XVII, figs. 2, 3.

*Foliis? Foliolis breviusculis, late-spathulatis, ut videtur, folii compositi foliola constituentibus; margine apicali laciniato, laciniis angustis acuminatis; nervis, ut videtur, crassiusculis, dichotomis, ramis lacinias intrantibus.*

• From the leaflets at our disposal one can form no idea of the entire leaf; but so much appears to be certain, that the leaf was pinnated just like in the former species, and that the leaflets under consideration are only the pinnulæ of a compound leaf. These differ, however, entirely from those in the former species; they are shorter and broadly spathulate; the apical margin deeply incised, the slashes are narrow and acuminate, showing a fan-like arrangement; it appears also that they are slightly plaited. The veins appear to be very broad, dichotomous, the branches entering the slashes. The leaves also appear to be plaited along the veins, and this circumstance, coupled with the possible wearing away of the ridges of the folds, may probably contribute to make the veins appear broader than they really are.

This species is to *Nöggerathiopsis hislopi* in the same relation as is amongst the carboniferous plants, *Nöggerathia intermedia*, Estm. (sen.), to *Nöggerathia foliosa*, Sternhög. I am sorry to say that I cannot refer to the figures in Visiani's paper<sup>1</sup> on leaves of *Nöggerathia*, that volume of the Memoires of the Instituto Veneto not being procurable in Calcutta at this moment.

*Occurrence in South Rewah: Lower Gondwánas: Karharbári beds.*—Dhamni, south-east of Khaira (Hughes, 1881—the figured specimens).

## SQUAMÆ.

Plate XIV, figs. 4, 5, 7, 8, 10.

I have already in my Damúda-Panchet Flora (*l. c.*, p. 119) pointed to certain scale-like fossils, the systematical position of which was not quite certain, but which showed analogies with similar forms described from elsewhere.

I have at present again figured several of these peculiar forms without being, however, able to add anything further to the proper understanding of them.

Two of the specimens (Pl. XIV, figs. 4, 5) show in the lower portion a peculiar impression as if of the place of attachment. These forms resemble very much similar ones described from the Altai Jura, and they are apparently there in connection with *Rhizozamites*, as here, in India, with *Nöggerathiopsis*.

*Occurrence in South Rewah: Lower Gondwánas: Karharbári beds.*—Dhamni, south-east of Khaira (Hughes, 1881). Some are also from Harri (1881).

<sup>1</sup> Di alcuni generi di piante fossili—Mem. dell' Instit. Veneto, Vol. XVIII.

## SEMINA.

CARPOLITHES MILLERI, *Festm.*, Pl. XV, figs. 5—12.

1881. Feistmantel: Suppl., Talcir-Karharbári Flora, Gondwána Flora, Vol. III, pt. 1, Pl. XXX, fig. 14.

A very peculiar seed was described and figured by me in the above work, from the typical Karharbári beds, in the Karharbári coal-field. Several specimens of the very same seed were collected by Mr. Hughes at one locality in South Rewah; it was chiefly from this occurrence, in combination with the other fossils, that I thought myself justified in considering this locality, as well as two others in its near neighbourhood,<sup>1</sup> as also belonging to the Karharbári beds.

The specimens of this seed from South Rewah are so exactly like the one described from the Karharbári coal-field that I may simply refer the readers to my original description.

About their systematical position we again can judge indirectly only from their association with other fossils; the only plant they were found with is *Nöggerathiosis*, and thus we arrive at the same conclusion, that the seeds have most probably to be referred to this genus, which is the more natural if we consider that genus to belong to the *Zamia*.

From the several specimens now figured, it appears more than probable that the attachment of the seeds was by their broad part, which may thus be termed the basal portion; in fig. 7 (Pl. XV) we even see a fragment of a stalk by which the fruit was no doubt attached.

*Occurrence in South Rewah: Lower Gondwánas: Karharbári beds.*—Dhamni, south-east of Khaira (Hughes, 1881—the figured specimens).

## CONIFERÆ.

Coniferous plants are not uncommon amongst the fossils from South Rewah, though confined almost to one horizon. There are both branches and seeds, some of the former being of particular interest. Most of the forms are, however, such as have been already described, and these will only be briefly mentioned.

## Order: ABIETACEÆ.

GENUS: VOLTZIA, *Bgt.*VOLTZIA HETEROPHYLLA, *Bgt.*

1881. Feistmantel: Gondwána Flora, Vol. III, pt. 2, Pl. XLVIIa, figs. 20, 22, 24.

I have already figured three specimens of this species (see *l. c.*), so that there is no need of producing figures here again. Some amendment has, however, to be

<sup>1</sup> Dhamni and two spots near Hardi, all three at no great distance, in a southern direction from Khaira.



made as regards the distribution of the species in South Rewah. I quoted it in the above work from two localities, including both under the heading of *Raniganj* group. This has, by later discoveries, proved to be not quite correct, as one of the localities apparently belongs to a lower horizon.

*Occurrence in South Rewah: Lower Gondwānas—*

(a) *Raniganj* group: South Rewah (*Coll. J. G. Medlicott, 1861, l.c., Pl. XLVIIA, figs. 20, 24*). These specimens are believed to come from the Gopat area, in which case they would come from the above horizon.

(b) *Karharbāri beds*.—Two places south of Khaira, *viz.*, near Hardi and between Hardi and Sarangpūr (*Hughes, 1880-81, l.c., fig. 22*). The first of these places I at first also classed with the *Raniganj* group, on account of the analogy of its fossils with those collected by Mr. J. G. Medlicott in South Rewah (Gopat area). Further discoveries of fossils by Mr. Hughes in the same neighbourhood however, especially at *Dhamni*, leave no doubt that these places at Khaira have to be classed rather with the *Karharbāri* beds.

GENUS: PALISSYA, *Endl.*

PALISSYA JABALPURENSIS, *Fstm.*, Pl. II, figs. 10, 10a.

1877. *Feistmantel: Gondwāna Flora, Vol. II, p. 96, and figures.*

This species was first described from the Sātpura basin; it was subsequently identified also from Nandgaon, and now we have it from South Rewah. From the latter there is, however, only one branch known, with somewhat narrower leaves, but leaving no doubt of its being of this species.

*Occurrence in South Rewah: Upper Gondwānas: Jabalpur group.*—Bansa, near Chandia (*Hughes, 1880—the figured specimen*).

GENUS: ARAUCARITES, *Sternbg.*

This genus is here represented by seeds and fruit scales, and by a branch with leaves which approaches closely a living form.

ARAUCARITES CUTCHENSIS, *Fstm.*, Pl. III, figs. 9, 11-15, 19; Pl. XII, fig. 5.

1876. *Feistmantel: supra, Vol. II, pt. 1, p. 62, figures.*

1877. *Ibid.*, pt. 2, p. 16. In this paper also several specimens from South Rewah were figured, Pl. XIV, figs. 11-13.

The specimens now figured are not very many and not very well preserved; two are, however, complete enough; compare fig. 11, Pl. III, and fig. 5, Pl. XII. They

show distinctly one seed in the bract, and this latter prolonged into a distinct appendix (slash), so common in seed-bracts of the cones of coniferous plants. I have already before mentioned their relation with *Arauc. brodiei* from the English Oolite.

*Occurrence in South Rewah : Upper Gondwánas : Jabalpur group.*—Bansa, on the Machrar river (Hughes, 1880, Pl. III, figs. 9, 11-15, 19); Chandia, near Barwar (1881, Pl. XII, fig. 5); Chandia, small stream south of, (Hacket, 1872—the figures in my Jabalpur flora).

ARAUCARITES MACROPTERUS, *Fstm.*, Pl. III, fig. 18.

1877. Feistmáptel: Gondwána Flora, Vol. I, p. 186, Pl. VIII, figs. 9-11.

It appears to me that this larger, much more broadly-winged, species is also represented amongst the South Rewah, Upper Gondwána fossils, but coming from a higher horizon than that from which it was originally described. If we compare fig. 18, on Pl. III, with the others on the same plate, and with fig. 5, Pl. XII, it will be apparent that it differs from these others, especially by the much broader, marginal part of the bract round the seed, which marginal portion is also thinner; these larger bracts naturally indicate a much larger fruit cone, and thus apparently a different plant.

*Occurrence in South Rewah : Upper Gondwánas : Jabalpur group.*—Bansa, near Chandia (Hughes, 1880—the figured specimen). This species was at first described from the Rájmahál group of Golapili, near Ellore, on the South Godávári; later it was identified from the Sripermatur group, and now we know it from the Jabalpur group in South Rewah, wherein there is altogether an admixture of Sripermatur plants; it is so at least at one locality.

ARAUCARITES (Araucaria) LATIFOLIUS, *n. sp.*, Pl. II, fig. 6.

As there is only one branchlet known of this plant, and as even this does not, show all the usual and necessary characters, it would be hardly worth while to construct a diagnosis of the plant: a description may be sufficient for the present.

The branchlet does not show any indication of ramification, and so we may assume that it is probably a terminal branchlet. The leaves form the chief character. I cannot say with certainty whether they are arranged spirally or not, although it appears to be so, especially in the upper portion of the branchlet. The leaves are about one-half to three-quarters of an inch long and about one-quarter of an inch broad, oblongly ovate, somewhat pointed at the apex, and somewhat narrowed at the place of insertion. There are no veins visible in the fossil, but it is most probable that there were several veins, which in this case would be thinner, and so disappear more easily in the impression; while if there had been only one central rib, this, being as a rule much thicker, would probably have remained visible in the impression also. This consideration has its meaning, for on it depends

whether the fossil is an *Araucaria* or a *Cunninghamia*. My belief is that it belongs to the former genus, under which genus it is here described.

It is rather a singular type, and there are not many forms to compare with it. There is in Saporta's work on Jurassic plants,<sup>1</sup> Vol. III, Pl. CXLVI, fig. 5, a portion of a branchlet of an *Araucaria* (*A. Bidwillii*, Hook), which to some extent resembles our fossil; the leaves in the former are, however, longer, the apical portion much more produced, and the basal portion more distinctly constricted. A somewhat greater resemblance to our fossil is found in the genus *Albertia*, Schimp. and Moug. (*Haidingeria*, Endl.), especially *Alb. latifolia*, Schimp. and Moug.,<sup>2</sup> but, as already remarked above, it cannot be said from our specimen whether the plant was pinnately branched or not. There is, however, one thing to be said about these two genera (*Araucarites* and *Albertia*), that they both belong to the same order, *via.*, *Abietineæ*. Another, somewhat more distant, similarity is found in certain plants figured in Zigno's Memoir on Trias plants from Recoaro, which were collected by Prof. Massalongo.<sup>3</sup> I refer to figs. 1 and 5 on Pl. VIII of the said Memoir, which are described as *Haidingeria* (= *Albertia*) *Schauerthiana*: this would also agree well with the preceding comparison, but Schimper does not think these plants from Recoaro to be *Albertia*, so that it is not of much use to compare our fossil with this doubtful plant.

*Occurrence in South Rewah: Upper Gondwānas: Jabalpur group.*—Bansa, near Chandia (Hughes, 1880—the figured specimen).

### Genus: PACHYPHYLLUM, Sap.

Saporta, *l. c.*, p. 373, Vol. III.

PACHYPHYLLUM PEREGRINUM, Schimp., Pl. III, figs. 4, 7, 8, 16.

1879. Saporta: *l. c.*, Vol. III, p. 383, Pls. 173, 174, 175, and 176.

1879. Feistmantel: Gondwāna Flora, Vol. I, p. 218, Pls. XI, XII.

When assigning some specimens from the Madras coast to the above species, I referred particularly to the species as defined and figured by Saporta in his above work; I must do the same in the present instance. I figure four specimens, which I think all belong to the same species. We take first fig. 7: this presents thickish branches covered with transversely rhombical or tetragonal leaves produced into a point above, as can be seen on the margin of the branches, where the leaves are compressed from the side. They also appear slightly keeled. In some places the leaves have fallen off, and then the bare stem appears, and the imbricated arrangement of the leaves is well shown, especially so in the left branch in the figure. This specimen agrees very well with the figure given by Saporta, *l. c.*,

<sup>1</sup> Palæontologie Française, 2d. Série: Végétaux—Terrain Jurassique. Liv. 22, 1877.

<sup>2</sup> Schimper and Mougeot: Plantes fossiles du Grès bigarré, Pl. II.

<sup>3</sup> Plante fossili del Trias di Recoaro, raccolte dal Prof. A. Massalongo—Osservazioni del Barone Achille de Zigno, 1862.

Pl. 174, fig. 2, and is of the same type as the specimen from the Sripermatur group (Vemáveram shales) figured in my above work.

I now come to the specimens, figs. 4, 8, and 16. I was for some time uncertain to what species they should best be referred, though there appeared no doubt that they belong to *Pachyphyllum*, and I at last arrived at the conclusion that they most probably are the thinner branchlets of the specimen in fig. 7. This view is supported by the following circumstances—(a) both belong to the genus *Pachyphyllum*; (b) in the diagnosis of the species the leaves are described as variable in size and form; (c) Saporta himself figured on Pl. 176, fig. 3, a specimen of a branchlet, with which our figures agree sufficiently in form and size of the leaves to be identified with it; (d) in support of the foregoing points it may be added that all the specimens figured by me were found in the same rock at the same spot.

In the thinner branchlets the leaves are oblong, attached with a somewhat broader base, tapering towards the apex, where they are slightly incurved and traversed by what appears to be a middle vein, which is also seen in the leaves of Saporta's figures of *Pachyphyllum peregrinum* (*l. c.*, Pl. 176, fig. 8).

*Occurrence in South Rewah: Upper Gondwánas: Jabalpur group.*—Bansa, on the Machrar river (Hughes, 1880—the figured specimens).

#### PACHYPHYLLUM, sp., Pl. III, fig. 10.

This branchlet is figured, although it is not very well possible to determine it with certainty. There appears no doubt to its being a *Pachyphyllum*, but the specific determination is somewhat more doubtful. The question might perhaps be easily solved by assigning it also to *Pachyphyllum peregrinum*, Schimp.; but the leaves are much narrower and more closely set, and I would rather compare it with *Pachyphyllum heterophyllum*, as figured in my flora of the Upper Gondwánas on the Madras coast (*l. c.*, Pl. XVI, fig. 16).

*Occurrence in South Rewah: Upper Gondwánas: Jabalpur group.*—Bansa, near Chandia (Hughes, 1880—the figured specimen).

#### Order: TAXODIACEÆ.

#### Genus: ECHINOSTROBUS, Schimp.

#### ECHINOSTROBUS EXPANSUS, Stbg., sp.

1877. Feistmantel: *supra*, Vol. II, p. 97, Pl. XI, fig. 5.

When describing this species in the Memoir referred to, I also figured a specimen from South Rewah; no other specimens having since been procured, I refer to that figure.

*Occurrence in South Rewah: Upper Gondwánas: Jabalpur group.*—Chandia, small stream south of (Coll. Hacket, 1872—the specimen figured in my Jabalpur

flora; in that memoir I have not specified the locality, mentioning only generally South Rewah).

ECHINOSTROBUS RHOMBICUS, *Fstm.*, Pl. III, figs. 6, 6a.

1877. *Supra*, Vol. II, p. 98, Pl. XI, figs. 6—11.

This species also has been already described from South Rewah in my above work, and several figures were given; the specimens were collected by Mr. Hacket several years ago; the same species was, however, lately collected again by Mr. Hughes at a place not far from Mr. Hacket's locality; the recent specimen is entirely identical with the original type specimens to which I refer.

*Occurrence in South Rewah: Upper Gondwānas: Jabalpur group.*—Chandia nadi, south of (Hacket, 1872, Jabalpur flora, *l. c.*, Pl. XI, figs. 6—11); Chandia, south-east of, near Barwar (Hughes, 1880—the present figure).

Genus: BRACHYPHYLLUM, *Bgt.*

BRACHYPHYLLUM MAMMILLARE, *L. & H.*, Pl. III, figs. 2, 5.

1877. Feistmantel: *supra*, Vol. II, p. 96, and figures.

Several specimens of this fossil conifer, first described from the English Oolite, were figured in my above work; they were from the Jabalpur group at Jabalpur. At present I figure two specimens from South Rewah, which exactly agree with those mentioned above from the Jabalpur group: we have only to compare the figures given now, especially fig. 5 (Pl. III), with those given previously, especially Pl. XIII, figs. 2—4, and the identity is quite evident. The specimens figured at present are only unramified branchlets. Fig. 5 shows only the rhomboidal scaly impressions of the leaves, while fig. 2 appears to show the leaves in a more complete condition, something like in the figure in my Jabalpur flora, Pl. XIII, fig. 1a.

*Occurrence in South Rewah: Upper Gondwānas: Jabalpur group.*—Bansa, on the Machrar river (Hughes, 1880—the figured specimens); Sandabah river (Hughes, 1882).

Order: TAXACEÆ.

Genus TAXITES, *Bgt.*

TAXITES PLANUS, *Fstm.*, Pl. II, figs. 7-11.

1879. Feistmantel: Gondwāna Flora, Vol. I, p. 220, and figures.

This pretty conifer was at first described from the Sripermatpur group on the Madras coast, and from the equivalent Ragavapuram shales on the Southern Godāvāri; hitherto it was known from that group only, and its occurrence in South Rewah in a group which, from the general character of the fossils, must be

considered as on the horizon of the Jabalpur group, is thus of much interest. It is no doubt a surviving form of the lower Sripermatur group into the higher Jabalpur group of South Rewah, which after that further to the west, in the Jabalpur group of the Sátapura basin, dies out entirely, for it has never been met with in this latter district. The specimens in South Rewah are not by far so numerous as in the Sripermatur group, though just as well preserved. The best specimen, not only from South Rewah but in all our collections, is that represented in fig. 9, Pl. II; this is a branch about 5 inches long, but yet showing no ramification,—a circumstance which I have already noticed in previous descriptions. The specimen under consideration is, however, undoubtedly the end portion of a branch, so that from its length one might perhaps be justified in considering the branches to have been of a pendulous character.

The leaflets are long and very narrow, needle-like, with a pointed apex, very nearly horizontal to the rhachis of the branch, traversed by a midrib; they appear to be distichous when viewed only superficially, though on closer examination the bases of the leaves appear to be spirally inserted; but having a decurrent half-twisted stalk, the flat horizontal position of the leaves may easily be explained.

*Occurrence in South Rewah: Upper Gondwánas: Jabalpur group.*—Bansa, on the Machhar river (Hughes, 1880—the figured specimens).

### Family: *SALISBURIEÆ*.

### GENUS: *GINGKO*, *Thunb.*

I have already described two species of *Gingko* from the Jabalpur group in the Sátapura basin, and from the Sripermatur group on the south-eastern coast of India.

There is amongst the fossils from South Rewah a leaf, which I think has to be classed with this genus; it is figured on Pl. III, fig. 1; it has a semi-circular shape, with the lower portion produced into a thin stalk. The upper margin of the leaf seems to be slightly emarginated; the veins are very indistinct, but still a few are seen faintly passing out of the stalk into the leaf, and they are dichotomous.

This leaf differs from the others, mentioned above, by its shape and its stalk, this being much thinner than in any of the known species.

Professor Heer described several species from East Siberia, which, however, are almost all lobed forms, while the specimen under discussion is entire-leaved, so that in this respect it would come closer to *Gingko integriuscula*, Heer, from Cape Boheman in Spitzbergen, though it differs from it again in shape of the leaf and thinness of the stalk, so that it cannot be identified with any of the known species.

*Occurrence in South Rewah: Upper Gondwánas: Jabalpur group.*—Bansa, near Chandia (Hughes, 1880—the figured specimen).

SEEDS (*Coniferous*?).

SAMAROPSIS: Pl. XI, fig. 7; Pl. XVI, fig. 4c.; Pl. XXI, fig. 2.

There are, besides the fruits already described as *Carpolithes milleri*, Fstm., *Araucarites cutchensis* and *macropterus*, several seed vessels, which appear to be of coniferous plants. I quote them under the above generic name, as they are almost all of the same type. Similar seeds were also, on other occasions, quoted by me as *Samaropsis*. It is, however, difficult, or even impossible, to say to what plant they might belong, as they are as a rule associated with plants to which they cannot possibly be referred. I mention them only to show as what localities and in what horizons they occur.

*Occurrence in South Rewah: Lower Gondwánas—*

- (a) *Eaniganj group*.—Bajbai, on the Gopat river (*Coll. Hughes, 1880; Pl. XI, fig. 7*).
- (b) *Karharbári beds*.—Hardi, south-west of Khaira (*Coll. Hughes, 1880; Pinaora, Singwára district (Coll. Hughes, 1882, Pl. XXI, fig. 2)*).
- (c) *Talchir group*.—Anukpur (*Coll. Hughes, 1881, Pl. XVI, fig. 4c*).

SEEDS, probably of *Voltzia*.

There is another kind of small seeds that occurred rather numerous at a place where also branches of *Voltzia* were found, so that the supposition is very natural that these little seeds may be of that coniferous plant. They are small ovoidal seeds, slightly winged. They are amongst the specimens collected by Mr. J. G. Medlicott in South Rewah in 1861 (most probably, as mentioned before, from the Gopat coal-field).

With this the description of the remains of the vegetable kingdom is brought to an end.

About the animal remains there is nothing to be added to what I have already said, when mentioning the fossils of the locality Tiki, under the head Kota-Maléri beds.

## GENERAL REMARKS.

From the preceding pages it can be gathered that there is a good variety of species amongst the South Rewah plant fossils:

- (1) Of the *Equisetaceæ* three genera occurred, to the greatest extent in the Lower Gondwánas. Of these, *Vertebraria* deserves special notice, as it was found in the typical form in true Talchir rocks, and also passes beyond the limits of the Lower Gondwánas into rocks of Mahádeva appearance.
- (2) Ferns were much more numerous, and again predominant in the Lower Gondwánas, especially through the great number of species of *Glossop-*

- teris*. Of special interest is the new species of *Danaöopsis*; other new forms are: one species of *Gleichenia* and two species of *Glossopteris*.
- (3) Remains of *Cycadeaceæ* were rather rare as to variety of forms, though *Nöggerathiopsis hislopi* occurred very frequently, beginning in the Talchirs, and passing through the whole Lower Gondwánas into the beds beyond this division, headed Transitional beds. There is a new species of *Nöggerathiopsis*. The rarity of *Ptilophyllum* in the Upper Gondwánas is rather remarkable.
- (4) Coniferous plants show next to the ferns the most numerous representatives, and if we leave out of consideration two kinds of seeds, which probably also belong to coniferous plants, they are, with one exception, all of the Upper Gondwánas. One *Araucarites* is described as new. The occurrence of *Taxites planus* is specially to be noticed on account of its presence amongst plants and in rocks of the Jabalpur group, it having hitherto been only known from the Sripermatur group.
- (5) The animal remains are fresh-water shells and terrestrial (? fresh-water) reptiles.

#### COMPARISON WITH OTHER GONDWÁNA BASIN.

With regard to the serial sequence and to the continuity of the various groups, the South Rewah basin has in the first instance to be compared with the Sátpura basin, wherein a somewhat similar development of groups was described by Mr. H. B. Medlicott. But with regard to the fossils, the South Rewah basin shows a combination of forms of the various other basins to the east, south-east, and west. A few remarks will be sufficient to make this clear.

- (a) *Jabalpur group*.—The fossils of the Jabalpur group are on the whole such as were originally described from that group in the Sátpura basin, but in South Rewah we find an interesting addition in *Taxites planus*, hitherto a characteristic plant of the Sripermatur group on the south-east coast of India.
- (b) *Kota-Maléri beds*.—The fossils in this group in South Rewah are the same as those in this group in the Godávári region. These are hitherto the only two basins in which these fossils occurred in a similar association, although the scute of a *Parasuchian Crocodile* has been found in the Denwa group (Sátpura basin), about which there is little doubt that it represents the Kota-Maléri horizon.
- (c) *Transitional beds*.—These beds would find their closest analogy in the red shales on the northern face of the Latiahar hill in the Auranga coal-field.
- (d) *Raniganj group*.—The fossils from the localities in the Gopat area, as well as those on the Son river (in the Sohágpur district), represent the typical Raniganj group, as it was originally described from the Raniganj coal-



field, and identified hereafter in all the Damúda valley coal-fields, as well as in Ramkola-Tatapani coal-field. At most of the localities even the rock is similar. In the Sátpura basin the Bijori horizon is, with regard to the fossils, the true representative of the Raniganj group.

The other localities, which are also quoted under the heading of Raniganj group, but from the Sohágpur area, appear to me with regard to the fossils also to represent that group,<sup>1</sup> but the character of the rocks differs from that of the typical Raniganj group,—red colour, or light grey with reddish and brownish tints prevailing.

(e) *Barákar group*.—I must confess that the defining of the localities classed under this heading was done with a certain amount of uncertainty, for the specific difference of the fossils of this group from those of the Raniganj group is not very marked. In the Bengal coal-field, it is specially by the stratigraphical relations that the separation can be made, by the intervening iron shale band; but here, in South Rewah, where this latter seems to be wanting, the distinction is more difficult, the more so as the mineralogical character of the rocks of these two groups appears to be similar.

In the Sátpura basin there is a good difference between the Bijori horizon and the Barákar group. I hope, however, that those localities which I assigned to the Barákar group were assigned correctly.

(f) *Karharbári beds*.—The definition of these beds has been made from the character of the fossils, especially from the presence of *Gangamopteris*, *Voltzia*, and the great number of *Nöggerothiopsis*, which latter is greatly developed in the typical Karharbári beds of the Karharbári coal-field.

These beds in South Rewah are very nearly half-way between the Karharbári coal-field and the Mohpáni coal-field, the beds of which latter I also believe to represent the Karharbári beds.

(g) *Talchir group*.—This group is here well defined by the fossils and by the mineralogical character of the rock, both agreeing with those of the Talchir group in other coal-fields where fossils were found; but one particular character of this group in this basin has to be mentioned, *viz.*, the occurrence of a true *Vertebraria*.

<sup>1</sup> At Kunuk, near Jaitpur Sohágpur district, some fine specimens of *Schizoneura* have been found.



## EXPLANATION OF PLATES.

### PLATE I.

Figs. 1—11. *ASPLENIUM WHITBYENSE*, Heer., pages 28-29. Pinnæ of various varieties, representing *Asplenium whitbyense*, Heer, proper (figs. 1, 3—5, 8, 9, 11), and *Alethopteris indica* (figs. 2, 6, 7 and 10) ; figs. 4*a* and 10*a*, enlarged pinnulæ.

*Locality*.—Bansa near Chandia (figs. 1—9, 11) ; Jabalpur (10).

Figs. 12—14 *ALETHOPTERIS MEDLICOTTIANA*, Oldh., page 30.

*Locality*.—Bansa near Chandia.

Figs. 15—18. *GLEICHENIA REWAHENSIS*, n. sp., page 24. Portions of the frond, 16*a* and 17*a*, enlarged portions of pinnæ, to show the character of the pinnulæ and the larger size of the basal leaflets.

*Locality*.—Bansa near Chandia.

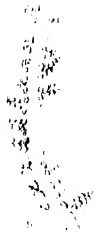
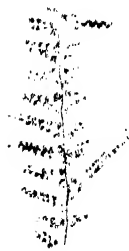
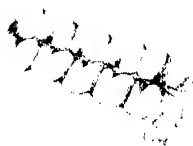
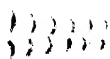
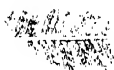






PLATE II.

- Fig. 1. *PECOPTERIS*, sp., indeterminable.
- Figs. 2—5. *PODOZAMITES LANCEOLATUS*, Lindl. & Hutt., pages 39-40. Various leaflets.
- Fig. 6. *ARAUCARITES LATIFOLIUS*, n. sp., pages 45-46. Branchlet covered with broad leaves.
- Figs. 7—9, 11. *TAXITES PLANUS*, Feistm., pages 48-49. Several branchlets, one of them (fig. 9) the largest and best preserved at present known ; 9*a*, enlarged leaves.
- Fig. 10. Branchlet of *PALISSYA JABALPURENSIS*, page 44, the leaflets somewhat narrower than in the usual form ; 10*a*, enlarged leaves.

*Locality*.—All specimens from Bansa, near Chandia.









### PLATE III.

- Fig. 1. *GINGKO*, sp., page 49. A rounded leaf with a thin stalk.
- Figs. 2, 5. *BRACHYPHYLLUM MAMMILLARE*, Lindl. & Hutt, page 48. Branchlets representing two different kinds of leaflets.
- Figs. 4, 7, 8, 16. *PACHYPHYLLUM PEREGRINUM*, Schimp., page 46. Stems and leaved branchlets.
- Fig. 6. *ECHINOSTROBUS RHOMBICUS*, Feistm., page 48. A branched specimen, showing well the rhomboidal leaves.
- Fig. 10. A coniferous branchlet, probably of *Pachyphyllum heterophyllum*.
- Figs. 9, 11—15, 19. *ARAUCARITES CUTCHENSIS*, Feistm., pages 44-45. Seed bracts in various states of preservation.
- Fig. 18. *ARAUCALITES MACROPTERUS*, Feistm., page 45. A larger seed bract, with a much broader marginal portion, which is also somewhat thinner.
- Fig. 17. *ECHINOSTROBUS* ? sp. Doubtful specimen.
- Fig. 20. FRUIT CONE of a coniferous plant.
- Locality*.—All the specimens here figured are from Bansa, near Chandia.

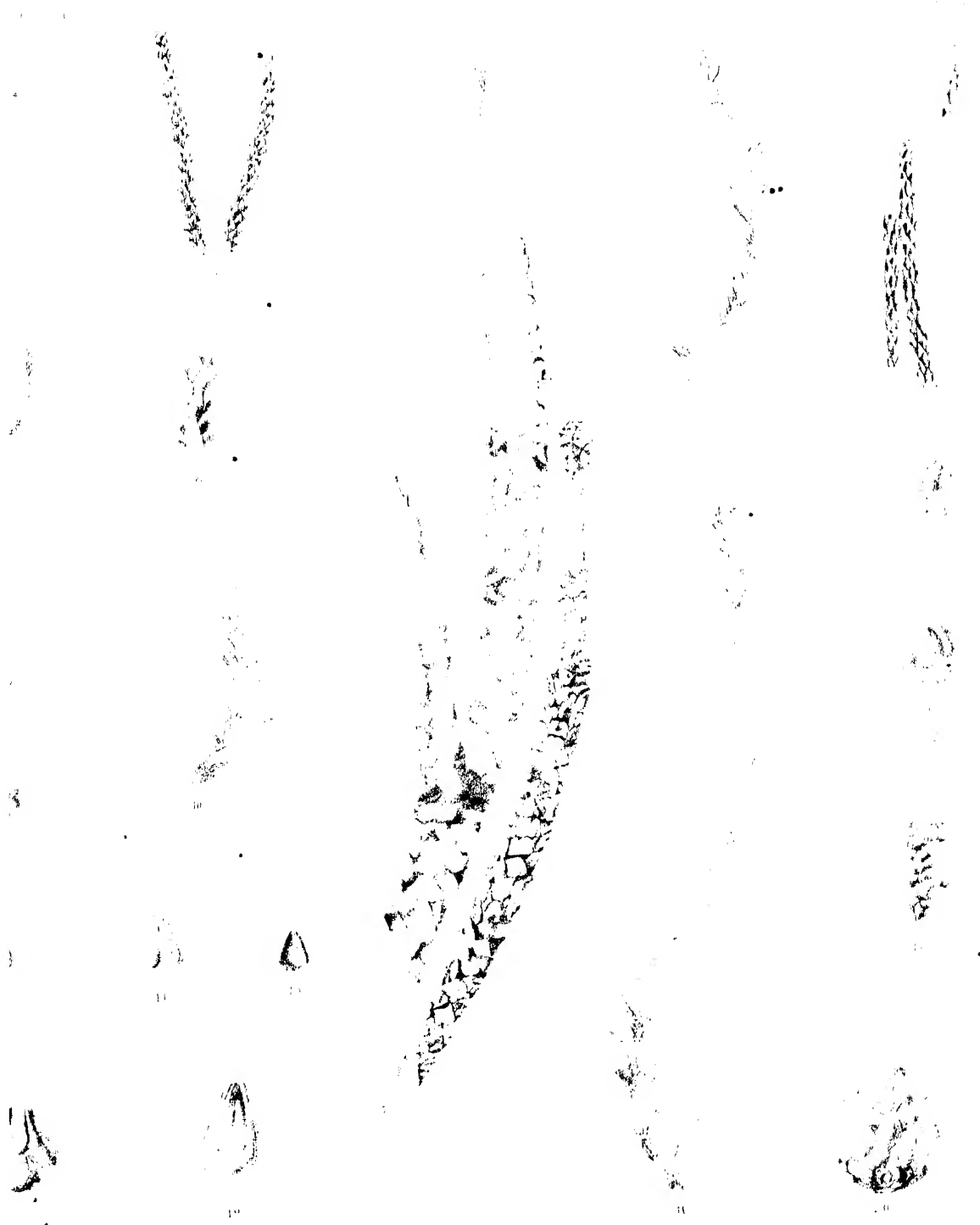


Plate 1. 1. *Leaves*. 2. *Stems*. 3. *Fruits*. 4. *Seeds*. 5. *Flowers*. 6. *Roots*. 7. *Stems*. 8. *Fruits*. 9. *Seeds*. 10. *Flowers*. 11. *Roots*. 12. *Stems*. 13. *Fruits*. 14. *Seeds*. 15. *Flowers*.





PLATE IV.

- Fig. 1. *DANÆOPSIS HUGHESI* Feistm., pages 25—27. Top portion of a leaf indicating a very large plant, the largest known among all the specimens which were found. The rhachis is distinctly wrinkled, and so are the rhachids of some of the pinnule.
- Locality.*—Parsora, near Beli. (Transitional beds.)



. Litho







PLATE V.

- Fig. 1. *DANÆOPSIS HUGHESI*, Feistm., pages 25—27. A specimen showing the bifurcation of the primary rhachis, and a portion of the two branches.
- Fig. 2. The same species. Specimen showing the top portion of the leaf ; the end portions of the two branches.

*Locality*.—Parsora, near Beli. (Transitional beds.)







## PLATE VI.

Figs. 1 & 2. **DANÆORSIS HUGHESI**, Feistm., pages 25—27. Two specimens, representing the lower portion of the frond, showing the dichotomy of the primary rhachis. In figure 1, there are below the point of dichotomy two pinnulæ, and above, within the fork, the leaflets are semi-circular, with radiary veins. Figure 2 exhibits within the fork similarly formed pinnulæ, which, however, increase in length towards the upper portion.

*Locality*.—Parsora, near Beli. (Transitional beds.)









PLATE VII.

Figs. 1 & 2. *DANÆOPSIS HUGHESI*, Feistm. pages 25-27. Fig. 1 seems to indicate a rather weak plant, as can be judged from the thin rhachis of the pinnæ as well as of the pinnulæ. The rhachis shows distinctly the transverse wrinkles. It was this specimen which I originally thought resembled *Neuropteridium*, but I afterwards convinced myself that it was only a portion of a branch of *Danæopsis hughesi*. Fig. 2 is a top portion of one of a branch of the same species.

*Locality*.—Parsora, near Beli.

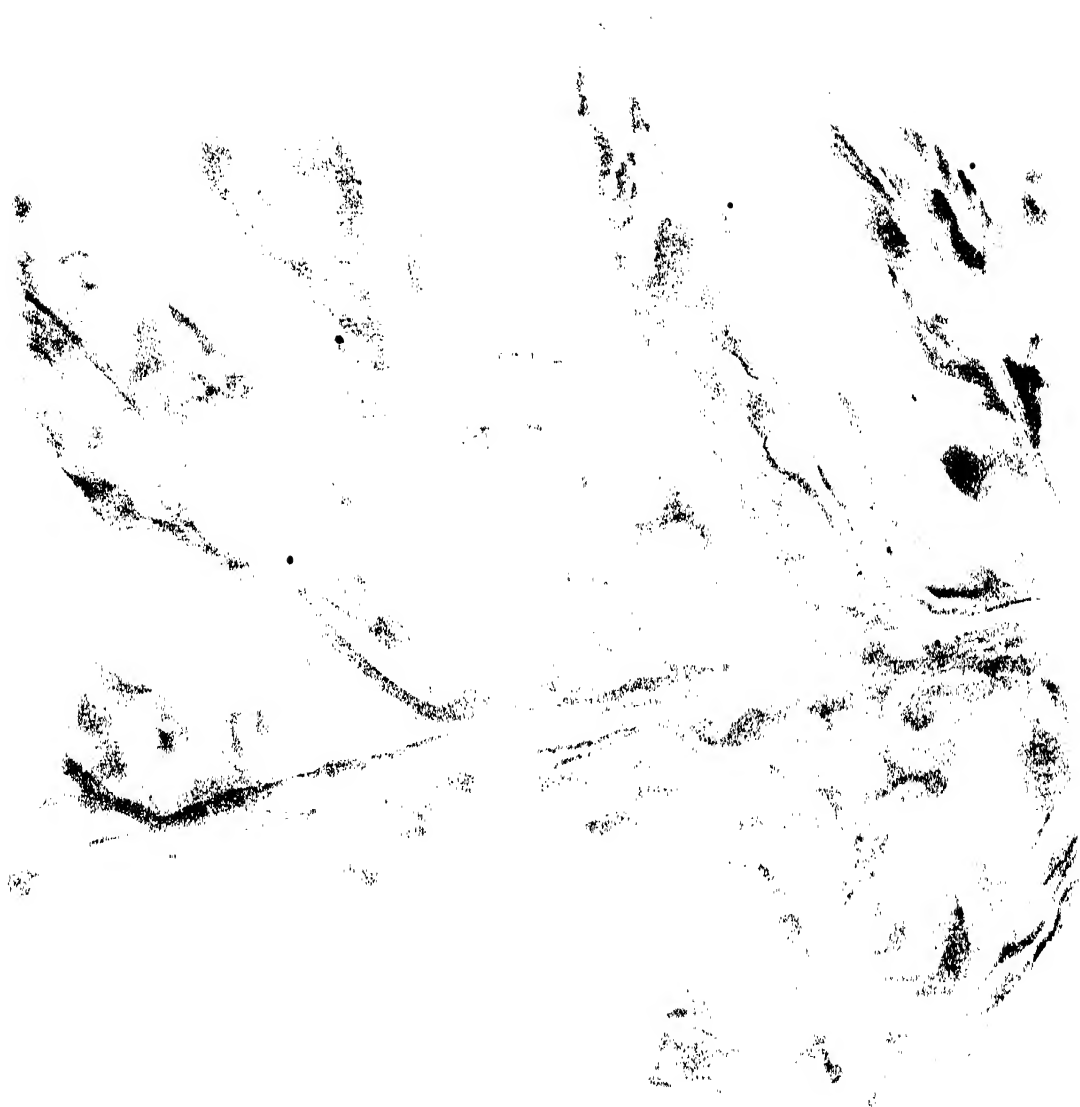






PLATE VIII.

- Figs. " 1—5. *DANÆOPSIS HUGHESI*, Feistm., pages 25—27. Fig. 1, showing portions of two branches, in their upper parts, after dichotomy of the primary rhachis. Fig. 2, a portion of a pinnulæ.
- Figs. 2 & 3. *ASPLENIUM WHITBYENSE*, Heer, pages 28-29. Specimens more in the form of *Althopteris indica*, Heer.
- Figs. 4, 6,<sup>1</sup> 7. *THINNFELDIA* comp. *ODONTOPTEROIDES*, Feistm., pages 30-31. Two of the specimens show dichotomy of the frond.

*Locality*.—All the specimens from Parsora, near Beli. (Transitional beds.)

<sup>1</sup> The number 6 on this plate is by mistake written reversed (9).





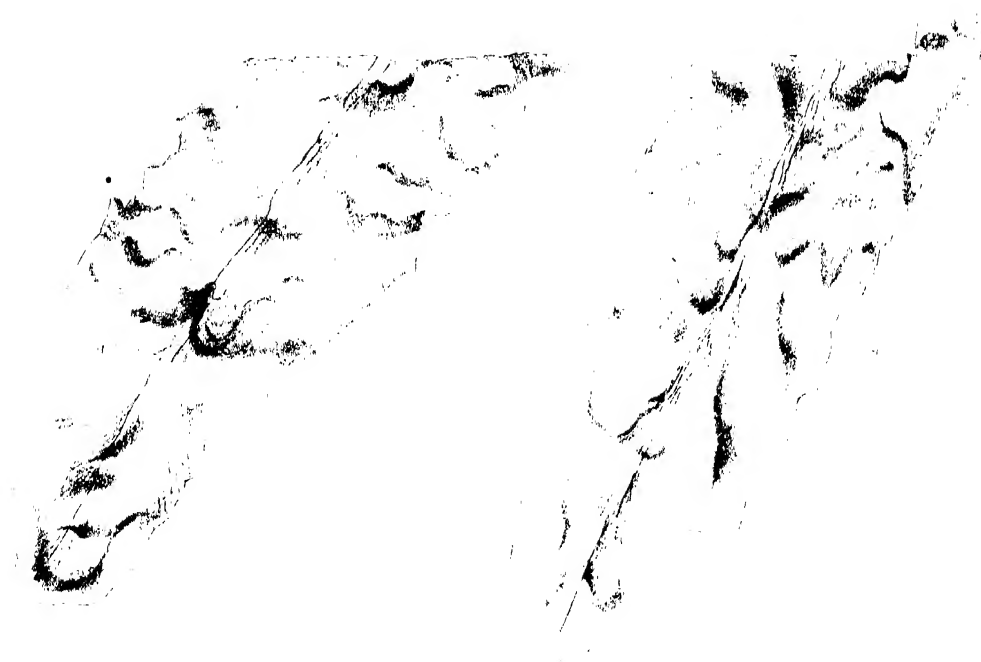
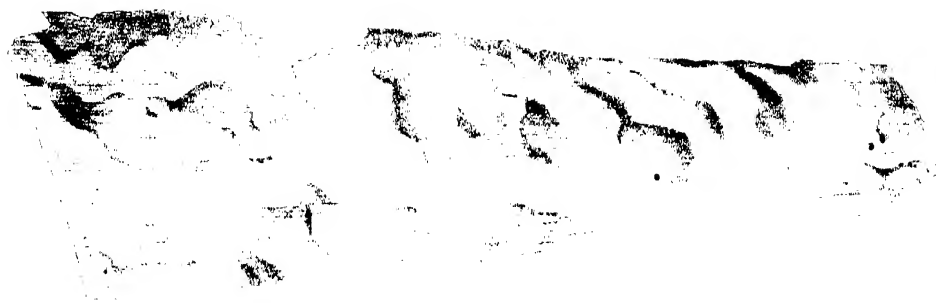




## PLATE IX.

- Figs. 1—3. *NEGGERATHIOPSIS HISLOPI*, Feistm., page 41. Figs. 1 and 3 portions of large leaves, the first being a basal, and the latter the apical portion; the dichotomous veins are sufficiently well shown. Fig. 2 is a small leaflet.
- Fig. 4. *DANÆOPSIS HUGHESI*, Feistm., pages 25—27. The apical portions of two pinnulæ, of large size.

*Locality*.—Parsora, near Beli. (Transitional beds.)







## PLATE X.

This plate represents a large specimen of *Danaöpsis Hughesi*. It is a restored figure, but not an invented one, being composed of several of the various specimens figured on the preceding plates. To judge from this figure, which, however, does not yet represent the entire frond, this species must have attained a considerable size. Here we see well the dichotomy of the frond pinnulæ below the point of dichotomy, and afterwards the various kinds of pinnulæ on the two branches, and on one of them the terminal pinnula.









PLATE XI.

- Fig. 1. VERTEBRARIA INDICA, Royl., pages 22-23. A branched form.  
*Locality*.—Daigaon, near Páli.
- Figs. 2-4. VERTEBRARIA INDICA, Royl., pages 22-23. Typical forms.  
*Locality*.—Bajbai, Gopat area.
- Fig. 5. EQUISETACEOUS Stem, showing ramification.
- Fig. 7. SAMAROPSIS? sp., page 50. Small winged seeds.
- Fig. 8. SCHIZONEURA GONDWANENSIS, Feistm., pages 21-22. Specimen showing splitting of the sheath along the joining lines of the leaflets.  
*Locality*.—The latter three specimens also from Bajbai.







PLATE XII.

- Fig. 1. *GLOSSOPTERIS COMMUNIS*, Feistm., pages 32-33. Usual type; 1*a*, enlarged portion.
- Fig. 2. Scale (*gymnospermous* ?), page 42.
- Fig. 4. *GLOSSOPTERIS BROWNIANA*, Bgt., pages 34-35. 3*a*, enlarged portion.  
*Locality*.—These three specimens are from Bajbai.
- Fig. 3. *DICKSONIA HUGHESI*, Feistm., page 28. Specimen in fructification; 3*a*, a leaflet enlarged, showing the venation; 3*b*, showing venation and mode of fructification.  
*Locality*.—Son river, near its junction with Murna nadi.
- Fig. 5. *ARAUCARITES CUTCHENSIS*, Feistm., pages 44-45. A pretty complete specimen, showing well the appendix on the bract.

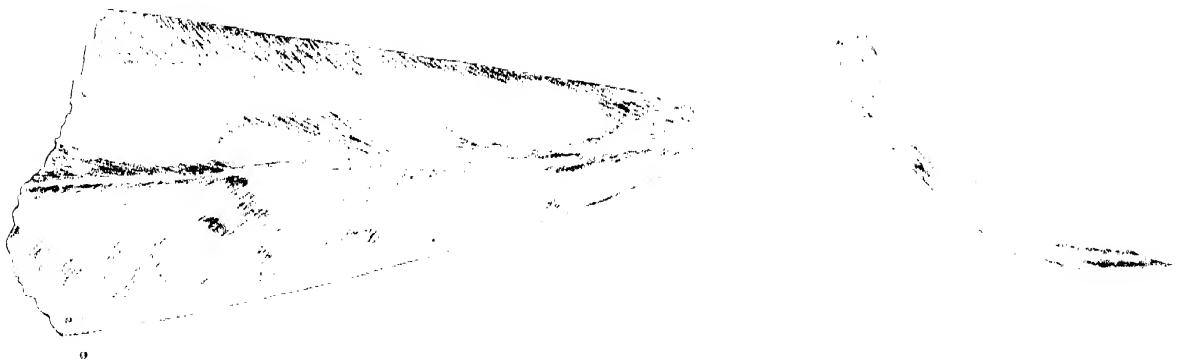
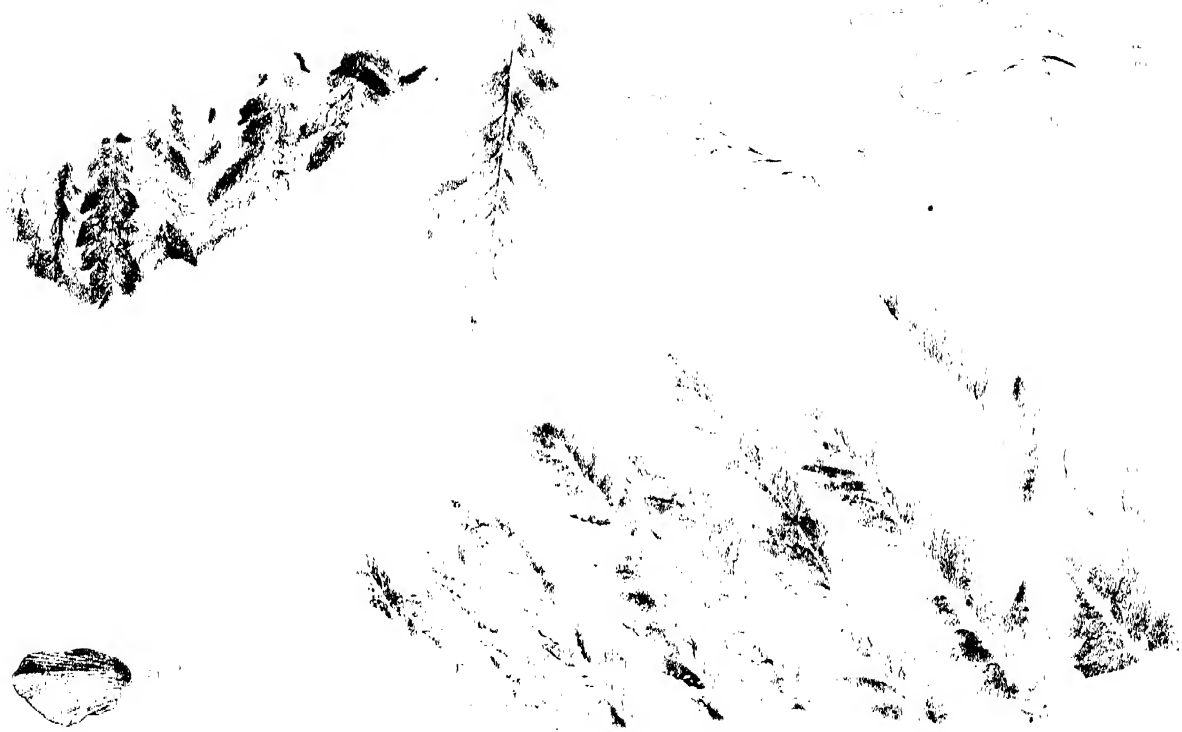
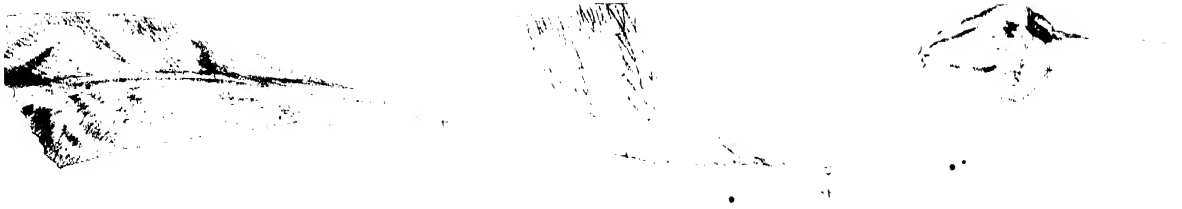








PLATE XIII.

- Fig. 1. SCHIZONEURA GONDWANENSIS, Feistm., pages 21-22. Portions of two, rather strong specimens. The stems thickish, the sheath-portions broad and long, showing distinctly the median veins of the leaflets and the commissural lines.  
*Locality.*—Son river, opposite Sursi.
- Figs. 2—4. NÖGGERATHIOPSIS HISLOPI, Feistm., page 41. Specimens in various states of preservation.  
*Locality.*—Junction of Johilla and Páli rivers.

17. 17. 17.







#### PLATE XIV.

Figs. 1—3, 6, 9. *NÆGGERATHIOPSIS HISLOPI*, Feistm., page 41. Portions of leaves, some of them indicating a very large size. All show the veins distinctly enough. In fig. 9 there are two leaves lying one across the other, but the vertical one is wrongly veined, all veins having been drawn entirely parallel—without any dichotomy.

Figs. 4, 5, 7, 8, 10. *SQUAMÆ*, page 42.

*Locality*.—All the specimens are from Dhamni, near Khaira.









PLATE XV.

Figs. 1—3, 4a. NÆGGERATHIOPSIS LACERATA, n. sp., page 42. Several leaves, showing the slit margin well.

Fig. 4b. NÆGGERATHIOPSIS HISLOPI, Feistm., page 41.

Figs. 5—12. CARPOLITHES MILLERI, Feistm., page 43. All the specimens represent the fruit in its, as I think, natural position; one specimen exhibits a short stalk.

*Locality.*—All these specimens are from Dhamni, near Khaira.

Figs. 13, 14. GANGAMOPTERIS MAJOR, Feistm., page 38.

*Locality.*—Between Hardi and Sarangpur, near Khaira.

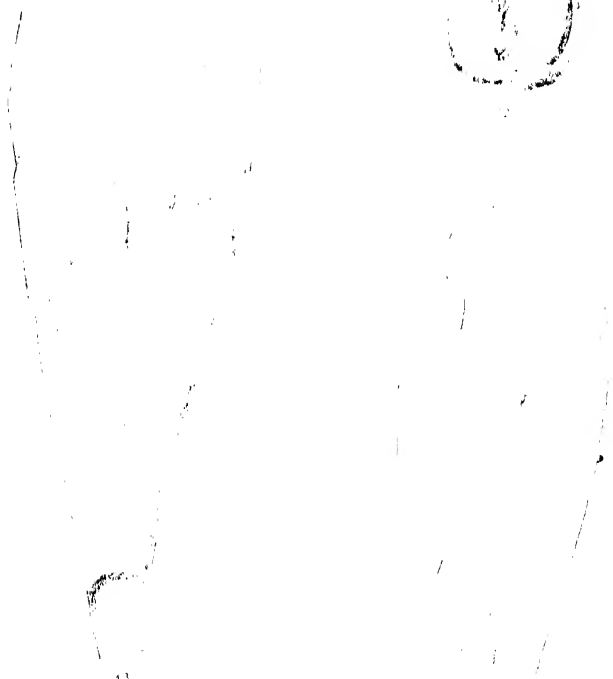






PLATE XVI.

Figs. 1—3, 4*a*. GANGAMOPTERIS CYCLOPTEROIDES, Feistm., page 37. The typical form.

Fig. 4*b*. GANG. CYCLOPT, *var.* ATTENUATA, Feistm., page 38.

Fig. 4*c*. Seed. SAMAROPSIS ? sp., page 50.

*Locality*.—All the specimens are from Anukpur. (Talehir group.)









PLATE XVII.

- Fig. 1. *DANÆOPSIS HUGHESI*, Feistm., pages 25—27. Another specimen showing dichotomy of the frond, and the top portion of the left branch ; it is a middle-sized specimen.  
*Locality*.—Parsora, near Beli. (Transitional beds.)
- Figs. 2, 3. *NÆGGERATHIOPSIS LACERATA*, n. sp., page 42.  
*Locality*.—Dhamni, near Khaira.
- Fig. 4. *NÆGGERATHIOPSIS HISLOPI*, Feistm., page 41. Lower portion of a middle-sized leaf.  
*Locality*.—Páli and Johilla rivers, junction of.







PLATE XVIII.

- Fig.**            1. **NÆGGERATHIOPSIS HISLOPI**, Feistm., page 41.    A narrow and elongate leaf.  
                    *Locality*.—Junction of Páli and Johilla rivers.
- Fig.**            2. **DANÆOPSIS HUGHESI**, Feistm.    Specimen described on page 27.  
                    *Locality*.—Parsora, near Beli.    (Transitional beds.)









PLATE XIX.

Figs. 1 & 2. *DANÆOPSIS HUGHESI*, Feistm., pages 25—27. Fig. 1 is an apical portion of a large frond, showing the terminal leaflet. Fig. 2, middle portion of a smaller frond, showing dichotomy of the primary rhachis; the branch to the right resembles very much the specimen figured on Pl. VII, fig. 1.

*Locality*.—Parsora, near Beli. (Transitional beds.)







PLATE XX.

- Fig. 1. *GLOSSOPTERIS CORDATA*, n. sp., page 34. The only specimen hitherto known.  
*Locality*.—Between Karkoti and Malhádu.
- Fig. 2. *GANGAMOPTERIS MAJOR*, Feistm., page 38. An almost entire leaf.  
*Locality*.—Bareri, north-west of Páli.
- Fig. 3. *GLOSSOPTERIS BROWNIANA*, Bgt., pages 34-35.  
*Locality*.—Guráru on the Son.
- Fig. 4. Seed—indeterminable.
- Fig. 5. *THINNFELDIA ODONTOPTEROIDES*, Feistm., pages 30-31.  
*Locality*.—These two specimens from Parsora, near Beli.
- Fig. 6. *SCHIZONEURA GONDWANENSIS*, Feistm., pages 21-22. A typical specimen.  
*Locality*.—Guráru on the Son.
- Figs. 7—9. *GIEICHENIA REWAHENSIS*, n. sp., page 24.  
*Locality*.—Umrar nadi, above Baragaon.
- Fig. 10. *NÆGGERATHIOPSIS HISLOPI*, Feistm., page 41.  
*Locality*.—Bareri, north-west of Páli. (Talchirs.)

of India



Schumann, Lith.

Printed by the Survey







## PLATE XXI.

- Fig. 1. *GANGAMOPTERIS CYCLOPTEROIDES*, var. *subauriculata*, Feistm., page 38.  
*Locality*.—Pinaora, Chindwára district.
- Fig. 2. SEEDS—*SAMAROPSIS*? page 50.
- Fig. 3. *GANGAMOPTERIS* comp. *angustifolia*, Bgt., page 39.
- Figs. 4, 9. *GLOSSOPTERIS TENIOIDES*, n. sp., pages 36-37.  
*Locality*.—All these specimens are from Pinaora.
- Fig. 5. *MACROTENIOPTERIS FEDDENI*, Feistm., page 31.  
*Locality*.—Guráru, on the Son river.
- Figs. 6, 8, 10. *NÆGGERATHIOPSIS HISLOPI*, Feistm., page 41. Various leaves.
- Fig. 7. *GANGAMOPTERIS CYCLOPTEROIDES*, var. *attenuata*, Feistm., page 38. Lower portion of the leaf.  
*Locality*.—These last four specimens are from Pinaora.
- Fig. 11. *GLOSSOPTERIS STRICTA*, Bunb., pages 33-37. The basal portion of the leaf.  
*Locality*.—Kachodhar, west of Sohágpur.
- Fig. 12. *GLOSSOPT. FORMOSA*, var. *MAJOR*, Feistm., page 38.  
*Locality*.—Guráru, on the Son.
- Figs. 13, 14. *GLOSSOPTERIS COMMUNIS*, Feistm., pages 32-33. Specimens showing fructification.  
*Locality*.—Kachodhar, west of Sohágpur.



1



2



3



4



5



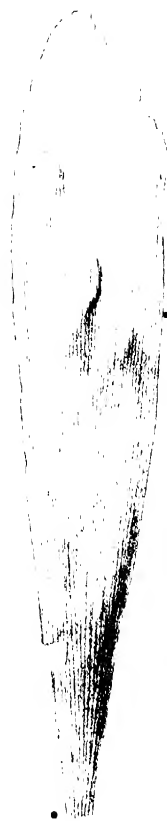
6



7



8



9



10



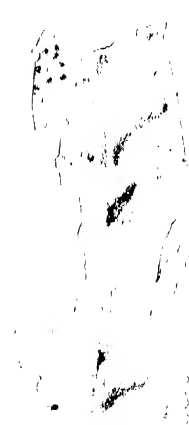
11



12



13



14



# MEMOIRS OF THE GEOLOGICAL SURVEY OF INDIA. PALÆONTOLOGIA INDICA.

## (SERIES I, III, V, VI, VIII.) CRETACEOUS FAUNA OF SOUTHERN INDIA.

- VOL. I. The Cephalopoda, by H. F. BLANFORD and F. STOLICZKA (1863-66), pp. 216, pls. 94. The Belemnitidæ and Nautilidæ, by H. F. BLANFORD, pp. 1-40, pls. 25. (*Out of print*). The Ammonitidæ, by F. STOLICZKA, pp. 41-216, pls. 71 (13 parts), (*complete*).
- VOL. II. The Gastropoda, by F. STOLICZKA (1867-68), pp. xiii, 500, pls. 28 (10 parts), (*complete*).
- VOL. III. The Pelecypoda, by F. STOLICZKA (1870-71), pp. xxii, 537, pls. 50 (18 parts), (*complete*).
- VOL. IV. The Brachiopoda, Ciliopoda, Echinodermata, Corals, &c., by F. STOLICZKA (1872-73), pp. v, 202, pls. 29 (5 parts). The Brachiopoda, pp. ii, 82, pls. 7. The Ciliopoda, pp. ii, 34, pls. 3. The Echinodermata, p. i, 59, pls. 7. The Corals, &c., pp. 70, pls. 12, (*complete*).

## (SERIES II, XI, XII.) THE FOSSIL FLORA OF THE GONDWANA SYSTEM.

- VOL. I, pp. xviii, 233, pls. 72, (*complete*).
- " pt. 1 (1863), (in six fasciculi), (*Nos. 4 and 5 out of print*). Rájmahál Group, Rájmahál Hills, by T. OLDHAM and J. MORRIS, pp. 52, pls. 35.
- " " 2 (1877). *Same, continued*, by O. FRISTMANTEL, pp. 53-162, pls. 36-48.
- " " 3 (1877). Plants from Golapilli, by O. FRISTMANTEL, pp. 163-190, pls. 8.
- " " 4 (1879). Outliers on the Madras Coast, by O. FRISTMANTEL, pp. 191-224, pls. 16.
- VOL. II, pp. xli, 116, pls. 26, (*complete*).
- " pt. 1 (1876). Jurassic Flora of Kach, by O. FRISTMANTEL, pp. 80, pls. 12.
- " " 2 (1878). Flora of the Jabalpur Group, by O. FRISTMANTEL, pp. 81-105, pls. 14.
- VOL. III, pp. xi, 64 + 149, pls. 64 (9 double) (I-XXXI, I A-XLVII A), (*complete*).
- " pt. 1 (1879). The Flora of the Talcir-Karharbari beds, by O. FRISTMANTEL, pp. 48, pls. 27 (5 double).
- " " 1 (Suppl. 1881). *Same*, Supplement, pp. 49-64, pls. (xxviii-xxxi) 4 (1 double).
- " " 2 (1880). The Flora of the Damuda and Panchet Divisions, pp. 77, pls. 18 (1 double (I A-XVI A, 14-16 bis).
- " " 3 (1881). *Same, concluded*, pp. 73 (77-149) pls. 31 (2 double) (XVII A-XLVII A).

## (SERIES IX.) JURASSIC FAUNA OF KACH.

- VOL. I (1873-76). The Cephalopoda, by W. WAAGEN, pp. i, 247, pls. 60 (4 parts), (*complete*).

## (SERIES IV.) INDIAN PRETERTIARY VERTEBRATA.

- VOL. I, pt. 1 (1865). The Vertebrate Fossils from the Panchet Rocks, by T. H. HUXLEY, pp. 24, pls. 6.
- " " 2 (1878). The Vertebrate Fossils of the Kota-Muluri Group, by SIR P. DE M. GREY EGERTON and L. MIALL, pp. 23, pls. 4.
- " " 3 (1879). Reptilia and Batrachia, by R. LYDEKKER, pp. 36, pls. 6.

## (SERIES X.) INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA.

- VOL. I, pp. xxx, 300, pls. 46, (*complete*).
- " pt. 1 (1874). Rhinoceros deccanensis, by R. B. FOOTE, pp. 18, pls. 3.
- " " 2 (1877). Molar teeth and other remains of Mammalia, by R. LYDEKKER, pp. 69 (19-87), pls. 7 (iv x).
- " " 3 (1878). Crania of Ruminants, by R. LYDEKKER, pp. 84 (88-171), pls. 18 (xi-xxviii).
- " " 4 (1880). Supplement to pt. 3, pp. 10 (172-181), pls. 3 (XXI A, B, XXIII A).
- " " 5 (1880). Siwalik and Narbada Proboscidea, by R. LYDEKKER, pp. 119 (182-300), pls. 18 (xxix-xlvi).
- " II, " 1 (1881). Siwalik Rhinocerotidæ, by R. LYDEKKER, pp. 62 (1-62), pls. 11 (1 double) (I-X, 2 bis.)
- " " 2 (1881). Supplement to Siwalik and Narbada Proboscidea, by R. LYDEKKER, pp. 4 (63-66). Issued with pt.
- " " 3. Siwalik and Narbada Equidæ, by R. LYDEKKER, pp. 32 (67-98), pls. 5 (XI-XV).

## (SERIES VII, XIV.) TERTIARY AND UPPER CRETACEOUS FAUNA OF WESTERN INDIA.

- VOL. I, pt. 1 (1871). Tertiary Crabs from Sind and Kutch, by F. STOLICZKA, pp. 16, pls. 5.
- " " 1 (new 2) (1880). Sind Fossil Corals and Alcyonaria, by F. MARTIN DUNCAN, pp. 110, pls. 28.
- " " 3 The Fossil Echinoidea: *Part I* (1882). The Fossil Echinoidea from the *Cardita beaumonti* beds, by P. MARTIN DUNCAN and W. PERCY SLADEN, pp. 20, pls. 4.

## (SERIES XIII.) SALT-RANGE FOSSILS, BY WILLIAM WAAGEN, PH.D.

- I. Productus-Limestone Group: 1 (1879). Pisces—Cephalopoda, pp. 72, pls. 6.
- " " 2 (1880). Gastropoda and supplement to pt. I, pp. 111 (73-183), pls. 10 (vii-xvi).
- " " 3 (1881). Pelecypoda, pp. 144 (185-328), pls. 8 (xvii-xxiv).

The price fixed for these publications is 4 annas (6 pence) per single plate.

To be had at the Geological Survey Office, Indian Museum, or through any Bookseller. London: Trübner & Co.

# MEMOIRS OF THE GEOLOGICAL SURVEY OF INDIA.

- VOL. I.** Royal 8vo, pp. 309, 1859. Pt. 1 (*out of print*): On the Coal and Iron of Cuttack.—Structure and Relations of the Talchir Coal-field.—Gold Deposits in Upper Assam.—Gold and Gold-dust from Shue-Gween. Pt. 2 (*price 2 Rs.*): Geology of the Khairi Hills.—The Nighiri Hills. Pt. 3 (*price 2 Rs.*): Geology of Ban-kooral, Midnapore, and Orissa.—Laterite of Orissa.—Fossil Teeth of Caracodina.
- VOL. II.** Royal 8vo, pp. 341, 1860. Pt. 1 (*out of print*): Report on the Vindhyan Rocks and their Associates in Bundelkand. Pt. 2 (*out of print*): Geological Structure of the Central Portion of the Nerbudda District.—Tertiary and Alluvial deposits of the Nerbudda Valley.—Geological Relations and probable Geological Age of the several Groups of Rocks in Central India and Bengal.
- VOL. III.** Royal 8vo, pp. 438. Pt. 1, 1863 (*out of print*): Report on the Raniganj Coal-field.—Additional Remarks on the Geological Age of Indian Rock systems. Pt. 2, 1864 (*price 2 Rs.*): On the Sub-Himalayan Ranges between the Ganges and Sutlej.
- VOL. IV.** Royal 8vo, pp. 450. Pt. 1, 1863 (*price 2 Rs.*): Report on the Cretaceous Rocks of Trichinopoly District, Madras. Pt. 2, 1864 (*price 2 Rs.*): On the Structures of the Districts of Trichinopoly, Salem, &c. Pt. 3, 1865 (*price 1 Re.*): On the Coal of Assam, &c.
- VOL. V.** Royal 8vo, pp. 354. Pt. 1, 1865 (*price 3 Rs.*): Sections across N. W. Himalaya, from Sutlej to Indus.—On the Gypsum of Spiti. Pt. 2, 1866 (*price 1 Re.*): On the Geology of Bombay. Pt. 3, 1866 (*price 1 Re.*): On the Jharia Coal-field.—Geological Observations on Western Tibet.
- VOL. VI.** Royal 8vo, pp. 395. Pt. 1, 1867 (*price 3 Rs.*): On the Neighbourhood of Lynyan, &c., in Sind.—Geology of a Portion of Cutch. Pt. 2, 1867 (*price 2 Rs.*): Bokaro Coal-field.—Rangarh Coal-field.—Traps of Western and Central India. Pt. 3, 1869 (*price 2 Rs. 8 As.*): Taptee and Nerbudda Valleys.—Frog-beds in Bombay.—*Oryzopsis pusillus*.
- VOL. VII.** Royal 8vo, pp. 342. Pt. 1, 1869 (*price 3 Rs.*): Vindhyan Series.—Mineral Statistics.—Coal.—Shillong Plateau. Pt. 2, 1870 (*price 1 Re.*): Kharibari Coal-field.—Deoghar Coal-field. Pt. 3, 1871 (*price 1 Re.*): Aden Water-supply.—Karanpura Coal-fields.
- VOL. VIII.** Royal 8vo, pp. 353. Pt. 1, 1872 (*price 4 Rs.*): On the Kadapah and Karnul Formations in the Madras Presidency. Pt. 2, 1872 (*price 1 Re.*): Ikhuri Coal-field.—Daltongunj Coal-field.—Chope Coal-field.
- VOL. IX.** Royal 8vo, pp. iv, 358. Pt. 1, 1872 (*price 4 Rs.*): Geology of Kutch. Pt. 2, 1872 (*price 1 Re.*): Geology of Napkur.—Geology of Sirban Hill.—Carboniferous Ammonites, pp. 65.
- VOL. X.** Royal 8vo, pp. 359. Pt. 1, 1873 (*price 3 Rs.*): Geology of Madras.—Sâtpura Coal-basin. Pt. 2, 1874 (*price 2 Rs.*): Geology of Pegu.
- VOL. XI.** Royal 8vo, pp. 338. Pt. 1, 1874 (*price 2 Rs.*): Geology of Dâjiling and Western Dâura. Pt. 2, 1876 (*price 3 Rs.*): Salt-region of Kohât, Trans-Indus, pp. 230.
- VOL. XII.** Royal 8vo, pp. 363. Pt. 1, 1877 (*price 3 Rs.*): South Mahrâtta Country. Pt. 2, 1876 (*price 2 Rs.*): Coal-fields of the Nâga Hills, pp. 95.
- VOL. XIII.** Royal 8vo, pp. 248. Pt. 1, 1877 (*price 2 Rs. 8 As.*): Wardha Valley Coal-field. Pt. 2, 1877 (*price 2 Rs. 8 As.*): Geology of the Râjmahâl Hills.
- VOL. XIV.** Royal 8vo, pp. 313. Geology of the Salt-range in the Punjab.
- VOL. XV.** Royal 8vo, pp. 191. Pt. 1, 1878 (*price 2 Rs. 8 As.*): Geology of the Aurnaga and Hutâr Coal-fields (Palanow). Pt. 2, 1880 (*price 2 Rs. 8 As.*): Ranikola and Tutapani Coal-fields (Sirguja).
- VOL. XVI.** Royal 8vo, pp. 264. Pt. 1, 1879 (*price 1 Re. 8 As.*): Geology of Eastern Coast from Lat. 15° to Masulipatam. Pt. 2, 1880 (*price 1 Re. 8 As.*): The Uncies and Transition Rocks, and other Formations of the Nellore Portion of the Carnatic. Pt. 3, 1880 (*price 2 Rs.*): Coastal region of the Godâvari.
- VOL. XVII.** Royal 8vo, pp. 305. Pt. 1, 1878 (*price 3 Rs.*): Geology of Western Sind. Pt. 2, 1880 (*price 2 Rs.*): Trans-Indus extension of the Salt-range.
- VOL. XVIII.** Pt. 1, 1881 (*price 2 Rs.*): Southern Afghanistan. Pt. 2, 1881 (*price 1 Re. 8 As.*): Mânbehûm and Sigbehûm. Pt. 3, 1881 (*price 2 Rs.*): Pranhitu Godâvari Valley.
- VOL. XIX.** Pt. 1, 1882 (*price 2 Rs.*): The Cachar Earthquake of 1869.

The price fixed for these publications is 5 Rs. (10s.) each volume.

Manual of the Geology of India, 2 Vols. and Map, 1879, *price 8 Rs. (16s.)*. 3rd Vol. (Economic Geology) 1881, *price 5 Rs. (10s.)*.

To be had at the Geological Survey Office, Indian Museum, or through any Bookseller. London: Trübner & Co.

## RECORDS OF THE GEOLOGICAL SURVEY OF INDIA.

The RECORDS of the Geological Survey are issued quarterly,—in February, May, August, and November. They contain brief reports and papers; abstracts of more detailed work; notices of recent discoveries; donations to Museum, and additions to Library, &c. They are of the same size as the 'Memoirs,' but are separately pagged.

The annual subscription for four numbers or parts is 2 Rs. (4s.). Postage additional, if forwarded, for India, 4 As., for Great Britain, 8 As. (1s.).

Fifty-eight parts or numbers have appeared; 1863, 3 Nos.; 1868, 4 Nos.; 1870, 4 Nos.; 1871, 4 Nos.; 1872, 4 Nos.; 1873, 4 Nos.; 1874, 4 Nos.; 1875, 4 Nos.; 1876, 4 Nos.; 1877, 4 Nos. with index to 1st Decade; 1878, 4 Nos.; 1879, 4 Nos.; 1880, 4 Nos.; 1881, 4 Nos.; 1882, 4 Nos.

CALCUTTA, November, 1882.

























